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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

All-wave Wireless

The Feature of this Season

DEVELOPMENT in wireless is continuous process which has been carried on without interruption since the earliest days. Yet, of necessity, a time lag has always occurred between the laboratory development of a new idea and its appearance as a commercial product The time elapsing between these two states is a very variable quantity, so that it often appears as if wireless development is by leaps and bounds rather than a progressive flow. We have thus become accustomed to expect something new after any apparent interval in progress and the natural time to look for its appearance is at the annual Radio Show. Past years have seen such developments as the superheterodyne, AVC, and visual tuning indicators, to mention only a few, and the question as to what to expect this year naturally arises at this time.

All the indications point to the fact that the feature of many of the new receivers will be an all-wave tuning range, using the term in its usual limited sense. From one point of view, this is hardly an innovation, since for many years it has been possible to obtain receivers covering a very wide tuning range. It is a development, however, in that the feature will be included in many receivers of the less expensive class. It is at the same time an achievement from the technical point of view and one which has probably caused more headaches among designers than any other within recent years. The difficulties of all-wave receiver design cannot be really appreciated except by those who have met with and overcome them.

The reasons why a demand has been created for this development are not far to seek. Listeners now find less interest than formerly in long-distance reception on the ordinary broadcast bands, for the reason that the high power of broadcasting stations has made it an easy matter to obtain almost any European station. The difficulty which persists is that of interference from adjacent stations and, as this is at present incapable of solution without serious effects on quality, many people are coming to rely solely on the local and a few of the stronger Continental stations for their entertainment. Short-wave reception gives back the lost interest in distance listening, whilst the range of reception is not merely Continental but world-wide. An element of skill, too, enters into the handling of the receiver and the range of wavelengths covered is so great and the diversity of stations receivable so large, that it is possible once more to enjoy a return to the much-maligned occupation of "knob-twiddling."

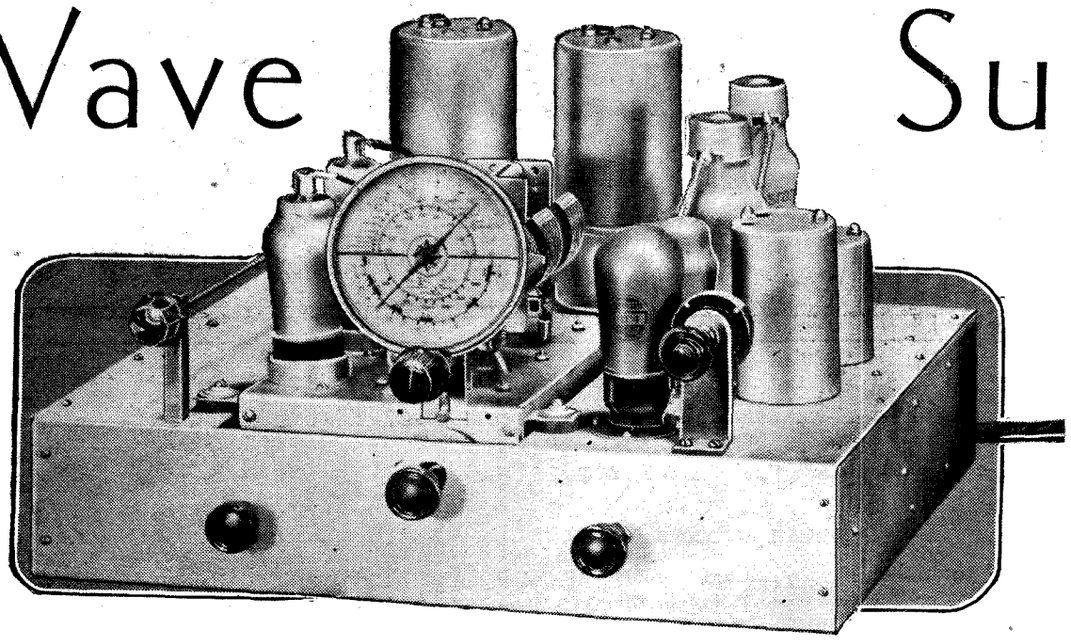
Opportunities for Experimenters

In the field of all-wave and short-wave sets, more than in any other, perhaps, those who experiment and build their own sets are at an advantage, because the technique is by no means stabilised and improvements are being made so rapidly that commercial practice cannot at present keep pace with them. The first AC operated all-wave receiver to be designed by *THE WIRELESS WORLD* for description as a constructional set is announced in this issue. This receiver is fully representative of modern technique. It is highly sensitive on all wavelengths, it is selective with the selectivity variable at will from a panel control. High-quality reproduction has been a principal aim, whilst the signal/noise ratio is good. A signal-frequency amplifier and two signal-frequency tuned circuits are in use on all wavelengths ; this feature alone is one which would have been almost impossible a very few years ago. The IF amplifier is also of a new and unusual design, and greatly facilitates the attainment of good variable-selectivity characteristics. The AVC system is one which does not introduce distortion but is yet effective in its chief purpose—that of reduction of fading.

The Wireless World

All-Wave Su

A SENSITIVE THREE-BAND SET WITH VARIABLE SELECTIVITY



THE increasing interest which is being taken in short-wave reception makes it desirable to include these wavelengths within the tuning range of sensitive receivers. That portion of the total range of wavelengths used for wireless communication which is usually termed short-wave extends from about 10 metres to 100 metres, but it is by no means essential to cover the whole of this band. The vast majority of short-wave broadcasting stations and amateur transmitters work between 16 and 50 metres, and it is this portion of the band which is essential.

Any increase in the tuning range is naturally reflected by a tendency towards an increase in cost, for more bands have to be included. It is therefore economical to make the tuning range no wider than is essential. Now it is just possible to cover some 16 metres to 50 metres in one band, and it has accordingly been decided to include only this short-wave range in the receiver in addition to the usual medium and long wavebands. The set consequently has three tuning ranges of approximately 16-50 metres, 180-550 metres, and 1,000-2,000 metres.

THE superheterodyne is the only type of receiver with which it is possible to obtain high selectivity on short wavelengths and it consequently lends itself well to the production of an all-wave receiver. The principle is one which has carried all before it in the field of broadcast reception and it is one which is equally suitable for short waves. The receiver described in this article covers three bands and a signal-frequency HF stage is always operative, thus keeping the signal-noise ratio at a maximum.

The complete circuit diagram appears in Fig. 1, and it will be seen that a signal-frequency amplifier employing an HF pentode type valve is employed and is operative on all wavelengths. The use of such a stage is advantageous in that it keeps the signal-noise ratio at a maximum, and the two tuned circuits very greatly reduce the possibility of second-channel interference even on short wavelengths.

The frequency-changer is of the heptode type, having a tuned-grid oscillator circuit. Correct ganging is secured by means of the padding condenser system, and use is made of the padding condenser also to assist in the reaction circuit. It can be seen that the coupling between the oscillator tuned circuit and the oscillator anode circuit is partially by means of the mutual inductance between the reaction and tuned coils, and partly by means of the reactance

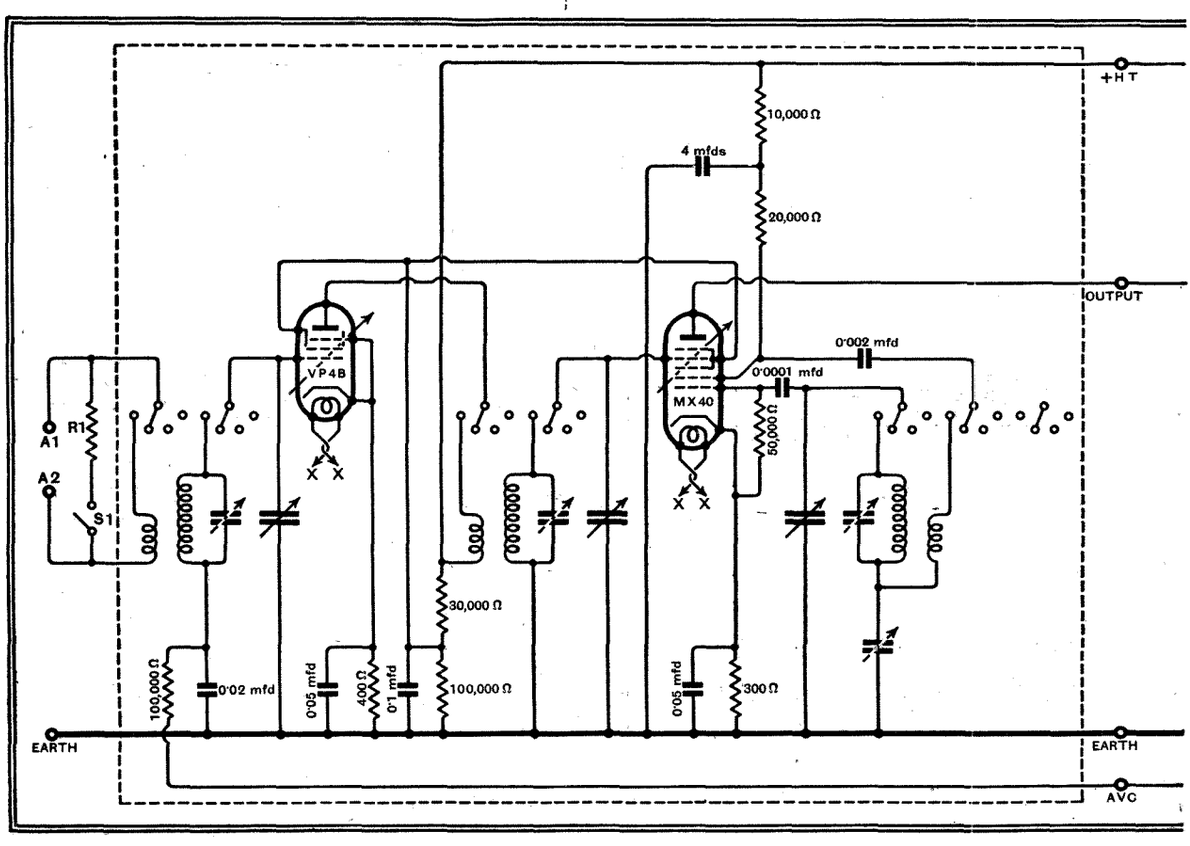
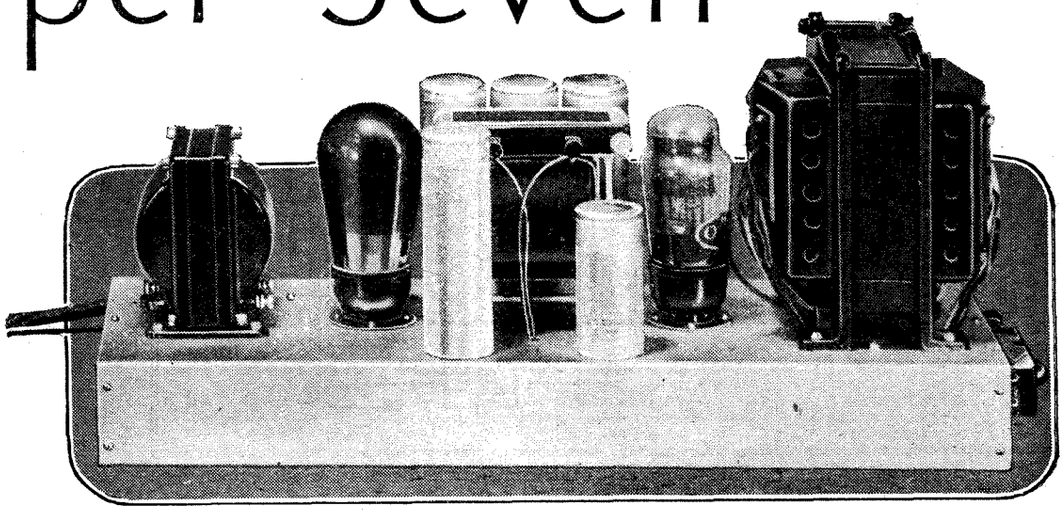


Fig. 1.—The complete circuit diagram of the receiver shows that two signal-frequency tuned circuits are used with a heptode frequency-changer and an HF pentode for the HF stage. There are two IF stages specially arranged with six tuned circuits to give good variable-selectivity characteristics.

per Seven

By W. T. COCKING



of the padding condenser which is common to both circuits. This particular arrangement of the circuit connections enables a much more constant output to be obtained from the oscillator, and so enables more even sensitivity to be secured.

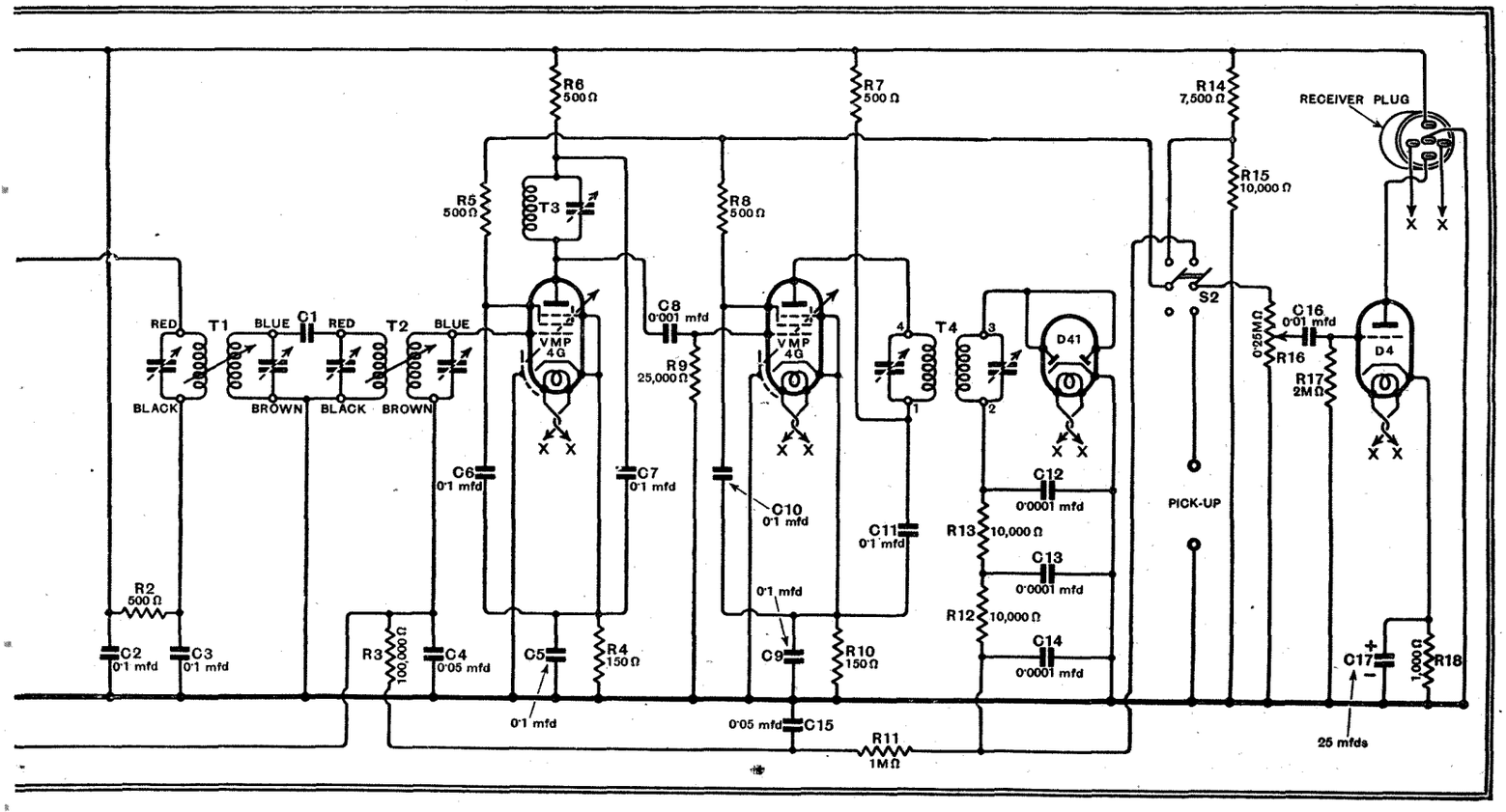
The inclusion of short waves in a receiver brings two big problems in its train—one of construction and the other of adjustment. On short wavelengths it is vitally important not only that the construction be sound but also that all connections are made correctly, and this does not mean merely joining together the correct points. It means that all connecting leads are important in their length and relative positions. If the apparatus is to be reasonably compact, this throws a big burden on the constructor, for it is all too easy unwittingly to make important errors. The second difficulty, that of adjustment, lies in the ganging, for it is not always easy to carry this out properly on short wavelengths, since comparatively few test oscillators cover the requisite range.

These difficulties have been completely overcome in this receiver by the use of a manufactured tuner. This tuner includes the whole of that portion of the circuit in the dotted box in Fig. 1—gang condenser, coils, switches, trimmers and valveholders all wired up and ready for use. Moreover, if the specified valves are used the ganging has already been performed in the factory, and no ganging adjustments are necessary. The only adjustments which the constructor has to make are to the IF amplifier, which must be lined up to the correct frequency of 456 kc/s for which the tuner is designed.

The IF amplifier includes two valves and is of rather special design in order to secure good variable-selectivity characteristics. Two variable-selectivity IF transformers are used between the frequency-changer and the first IF valve, and they are coupled together by the condenser C1. This condenser is of very small capacity and is constructed when wiring the set by the correct placing of two wires.

The IF Circuits

The frequency-changer anode is decoupled by the 500-ohm resistance R2 and the 0.1 mfd. condenser C3, the further 0.1 mfd. condenser C2 being provided to give a low-impedance path to HF across the HT supply. The coupling between the two IF valves is by a tuned anode circuit of high dynamic resistance but very low Q. This is done in order that the first valve may give good amplification but yet have a high input impedance—an important point if good variable selectivity characteristics are to be realised. The tuned circuit T3, therefore, is of high inductance and moderate efficiency. Even so, the Q is too high for correct results in this receiver, and it is accordingly adjusted to the right figure by the use of a low value—25,000 ohms—for the grid leak R9. This is advantageous in that it permits considerable latitude in the choice



The All-Wave Super Seven—

of operating conditions; it is, for instance, possible to use a higher value for R9 and so obtain greater gain in cases where this is more important than a flat resonance curve at low selectivity. Owing to the use of a low value of grid leak the coupling condenser C8 is given the fairly large value of 0.001 mfd.

The second IF valve is coupled to the diode detector by the transformer T4 having fixed coupling between its coils. This transformer has characteristics suited to the variable types and serves the purpose of filling up the trough in the resonance curve which would be obtained if the other two were used alone or if all three were variable.

The detector is a diode and also provides AVC. The by-pass condenser C12 has a capacity of 0.0001 mfd., and the output is taken through a two-stage filter comprising R12 and R13 of 10,000 ohms each and the two 0.0001 mfd. condensers C13 and C14. The diode load resistance R16 has a value of 0.25 megohm and acts also as the volume control. The DC output of the detector developed across R16 is fed off through the filter R11 and C15 of 1 megohm and 0.05 mfd. respectively to the AVC line. The first IF valve is controlled and has its bias applied through the filter R3 C4, which is also effective in feeding the HF valve, although this has a further filter incorporated in the tuner.

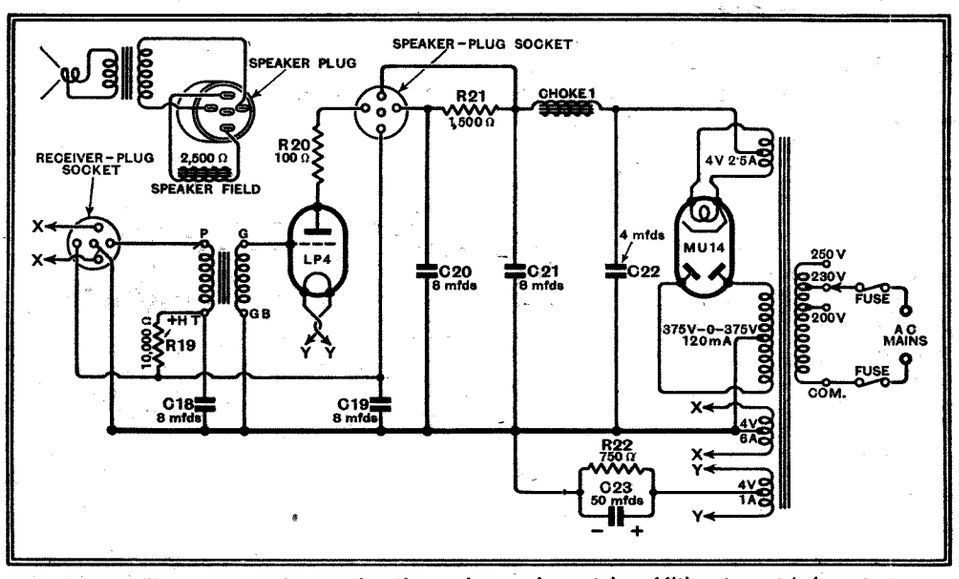


Fig. 2.—The power unit contains the mains equipment in addition to a triode output valve fed through a high quality LF transformer.

The second IF valve is not controlled; this is partly because AVC control would adversely affect the variable-selectivity characteristics by altering the valve damping on the primary of T4, but more because it would be likely to cause serious distortion on strong signals through overloading in this valve. The frequency-changer is also uncontrolled, in spite of the fact that the valve has variable-mu characteristics. The reason for this is that it is difficult to prevent the AVC voltage from affecting the oscillator frequency on short waves, and this would, of course, seriously interfere with the reception of a fading signal. Much more reliable results are secured, therefore, by omitting AVC control on this valve.

The AVC System

Some may be surprised at the use of non-delayed AVC, but recent articles in *The Wireless World* have shown it to be the only simple AVC system which is free from distortion. From the point of view of quality it has important advantages over the customary delayed diode system, and although it is inferior from the theoretical viewpoint in regard to its action in maintaining constant detector input, in practice it is very good. The only other arrangement which is satisfactory from the point of view of quality is an amplified method which involves an extra valve and many more components. Experience showed that the results with the simple diode circuit were so good that it was felt unnecessary to increase the complication and cost of the set by including amplified AVC.

If full output is to be secured on weak signals, a somewhat greater degree of LF amplification is needed with non-delayed AVC than with any delayed system. The detector output is consequently fed from

LIST OF PARTS

Certain components of other makes but of similar characteristics may be used as alternatives to those given in the following list.

RECEIVER.

1 Tuning unit and dial — Rothermel "Radio-Heart"
2 Variable selectivity IF transformers, with coupling unit, T1, T2 — Sound Sales IF465
1 IF transformer, T4 — Bulgin C50
1 IF coupling coil, T3 — Bulgin C43

Condensers:

2 0.05 mfd., tubular, **C4, C15** — T.C.C. 250
8 0.1 mfd., tubular, **C2, C3, C5, C6, C7, C9, C10, C11** — T.C.C. 250
3 0.0001 mfd., mica, **C12, C13, C14** — T.C.C. "M"
1 0.001 mfd., mica, **C8** — T.C.C. "M"
1 0.01 mfd., mica, **C16** — T.C.C. "M"
1 25 mfds. 25 volts, electrolytic, **C17** — T.C.C. "FT"

Resistances:

1 100 ohms ½ watt, **R1** — Erie
2 150 ohms ½ watt, **R4, R10** — Erie
5 500 ohms ½ watt, **R2, R5, R6, R7, R8** — Erie
1 1,000 ohms ½ watt, **R18** — Erie
2 10,000 ohms ½ watt, **R12, R13** — Erie
1 25,000 ohms ½ watt, **R9** — Erie
1 100,000 ohms ½ watt, **R3** — Erie
1 1 megohm ½ watt, **R11** — Erie
1 2 megohms ½ watt, **R17** — Erie
1 10,000 ohms 2 watts, **R15** — Erie
1 7,500 ohms 4 watts, **R14** — Erie

1 Volume control, tapered, 0.5 megohm, **R16** — Erie
4 Resistance boards 5-way — Bulgin C31
1 Resistance board 10-way — Bulgin C32
2 Valve holders 7-pin (without terminals) — Clix Chassis Mounting Standard Type V2
1 Valve holder 5-pin (without terminals) — Clix Chassis Mounting Standard Type V1
1 Valve holder 5-pin (special with 7-pin type fixing holes) — Clix Type CE457
1 Switch, rotary, DPDT, **S2** — Bulgin S114
1 Switch, rotary, SPST, **S1** — Bulgin S91
1 5-way cable with twin 70/36 leads and 5-pin plug — Goltone
1 5-way connector — Bryce
5 Ebonite shrouded terminals A (2), E, PU (2) — Belling-Lee "B"
2 Screened connectors — Bulgin P65
1 Pair bevel gears, equal sizes, 1:1 ratio, ⅜in. dia. × 26 teeth — Meccano Type 30
1 Large knob ¼in. bore — Bulgin K12
5 Small knobs ¼in. bore — Bulgin K14
1 5/32in. brass shaft 12in. long — Bulgin
1 Reducing sleeve for 5/32in. shaft to ¼in. knob — Bulgin
1 Length screened sleeving — Goltone
Chassis — Scientific Supply Stores

Miscellaneous:—

2 supports for control shaft 2½ins. long × ⅜in. sq., drilled for 4 BA screws; 8 lengths systoflex; 2 ozs. No. 18 tinned copper wire; bracket for volume control, etc. Screws: 6 4BA 1in. r/hd., 32 6BA ¼in. r/hd., 8 6BA 1in. r/hd., all with nuts and washers.

Valves:—

2 VMP4G metallised, 1 D41 metallised, 1 MX40 metallised — Osram or Marconi
1 D4 metallised — Ferranti
1 VP4B metallised — Mullard

POWER UNIT.

1 Mains transformer with screened primary; primary, 200 to 250 volts, 50 c/s.; secondaries: 375-0-375 volts, 120 mA; 4 volts 2.5 amps. centre-tapped; 4 volts 1 amp. centre-tapped; 4 volts 6 amps. centre-tapped. — Heayberd WS7
1 Smoothing choke 10 henrys 130 ohms 100 mA **Ch1** — Rich & Bundy E104M
1 LF transformer 3.5:1 ratio — Ferranti AF5

Condensers:—

1 50 mfds. 50 volts, electrolytic, **C23** — T.C.C. 521
1 4 mfds., 460 volts, electrolytic, **C22** — T.C.C. 802
4 8 mfds. 460 volts, electrolytic, **C18, C19, C20, C21** — T.C.C. 802

Resistances:—

1 100 ohms ½ watt, **R20** — Erie
1 10,000 ohms 1 watt, **R19** — Erie
1 750 ohms 2 watts, **R22** — Erie
1 1,500 ohms 20 watts, **R21** — Bulgin PR6

4 Valve holders 5-pin — Clix Chassis Mounting Standard Type VI
1 5-pin plug for speaker connection — Bulgin P3
1 4-way connector — Bryce Light Pattern
1 Fused mains input connector with 1½ amp. fuses — Belling-Lee 1114
Chassis — Scientific Supply Stores

Miscellaneous:—

3 lengths systoflex; 1 oz. No. 18 tinned copper wire, etc. Screws: 26 6BA ¼in. r/hd., 8 6BA ½in. r/hd., 9 4BA ¾in. r/hd., all with nuts and washers.

Valves:—

1 MU14 — Osram or Marconi
1 LP4 — Ferranti

The All-Wave Super Seven—

the volume control R16 to the grid of a triode LF amplifier through the 0.01 mfd. coupling condenser C16. The grid leak R17 has a value of 2 megohms, and the triode derives its bias by means of R18, which is shunted by a 25 mfds. condenser C17.

This triode is coupled to the output valve by means of a high quality transformer. This transformer, together with the output valve, are included on the same chassis as the mains equipment, and the circuit appears in Fig. 2. A triode delivering about 2.5 watts output is employed, and biased by the voltage drop along the 750 ohms resistance R22. An anode stopping resistance R20 of 100 ohms is used.

Turning now to the mains equipment, the mains transformer has secondaries rated at 4 volts 1 ampere for the output valve filament, 4 volts 6 amperes for the heaters of the early valves, 4 volts 2.5 amperes for the rectifier heater, and 375-0-375 volts at 120 mA. for the HT supply. A full-wave indirectly-heated rectifier is used, and delivers an output of about 390 volts unsmoothed, with a 4 mfds. electrolytic reservoir condenser C22. Preliminary smoothing is effected by the choke Ch1 in conjunction with an 8 mfds. condenser C21. The supply for the output valve is then tapped off, but as the voltage is rather high the feed is taken through the 1,500 ohms resistance R21, and another 8 mfds. condenser C20 is employed as a by-pass to earth. The supply for the early valves is further smoothed by being passed through the field winding of the loud speaker. This must have a resistance of 2,500 ohms and requires a current of some 50-60 mA. for adequate energisation.

The Valves

The construction of the receiver and its operation will be dealt with in next week's issue, but in the meantime some notes regarding the valves employed may be of interest. As long as the usual heater supply of 4 volts is employed no change can be recommended in the two valves used in the tuner. The HF valve is a Mullard VP4B, and differs from ordinary HF pentodes in having an unusually low input capacity, and also in having a top grid-connection; the grid is brought out to the top-cap and the anode to the base instead of the reverse. This leads to somewhat shorter leads, and a consequent reduction in stray capacities. The frequency changer is a Marconi or Osram MX40.

In the IF amplifier, Marconi or Osram VMP4G valves are used, and again no change can be recommended since they have been carefully selected to give the required performance. While other valves of similar characteristics will undoubtedly work and give quite good results, the same combination of high amplification, stability, and good variable selectivity characteristics may not be secured. The detector is not quite so important, and although the Marconi or Osram D41 has been used in developing the receiver, any duo-diode of similar characteristics can be employed.

For the LF valve and the output stage, Ferranti D4 and LP4 types are used, but exact equivalents exist in nearly all makes, so that quite a wide choice is permissible. The rectifier is a Marconi or Osram MU14. All valves, except, of course, the LP4 and MU14, should be metallised.

(To be concluded.)

On the Short Waves

NOTES FROM A LISTENER'S LOG

THE U.S. Federal Communication Commission's new rules relating to the operation of international broadcast stations such as W2XAF and W8XK have recently appeared and came into operation on August 1st. Some extracts from these rulings are given below, as it is felt that they may be of considerable interest to British listeners.

Firstly, these stations will no longer be called "Experimental Relay Broadcasting Stations" but "International Short-Wave Stations" as indicated in the first paragraph, and in addition, to quote from F.C.C. Rule 1012a, "but may transmit the programs of regular broadcast stations, including commercial stations, *if the call letters when identifying both stations are given on their respective assigned frequencies only* and the statement is made over the international broadcast station that the regular program of a broadcast station (identify by call letters) is being broadcast."

F.C.C. Rule 1012d states: "Station identification and program announcements shall be made with international significance suited for the foreign nation or nations for which the service is intended or in which the reception is believed to be best on account of the frequency, season and hour of operation."

Finally, Rule 1013b says: "A separate licence and call letters will be issued for each frequency except where frequencies in two or more groups are required to maintain a particular international broadcast service to certain foreign country or countries, one frequency from each of the groups required will be authorised by one licence and call letters.

"In such cases these frequencies shall be used consecutively during a day as required and they shall not be used simultaneously either on the same or different transmitters."

The minimum power rating is fixed at 5 kW except in special cases.

From these rules it would appear that the U.S. is beginning to take international short-wave broadcasting very seriously, and, coupled with this move on the part of the F.C.C., one hears rumours of impending changes in the equipment and aerials used by the N.B.C. transmitter W3XAL and the C.B.S. transmitter W2XE.

When one tunes into the various American commercial telephone and telegraph transmitters such as WKF, WLA, WMF, WDU, WCA, etc., it is obvious that reception of similarly equipped short-wave broadcasting stations would be well-nigh perfect over a large percentage of the time.

In fact, W2XAD, when using his European beam, a too rare occurence unfortunately, already gives us some idea of what may be achieved with 20 kW and a fairly simple horizontal array.

I have now some information regarding the "solar eclipse" station URAD (or UIBWF) which was operated by the members of the Harvard Eclipse Expedition to the U.S.S.R. in June. URAD, a 50-watt transmitter, was situated in a Russian baggage car of pre-War vintage, and functioned generally on 14.041 Mc/s (and on two other special frequencies) under the able guidance of W2BWF.

Most of the traffic was cleared with SM5SX and SU1CH, but one 'phone QSO was made with the U.S., and this, of course, right over the North magnetic pole!

A number of CW contacts was made with the States, however.

Finally, to close our American chapter, since July 15th W2XAD has been running 1¾ hours later than usual, i.e., until 9.45 p.m. BST.

Short-wave Broadcasting

Conditions seemed to have been fairly good during the week which ended on Sunday, July 19th, and W2XE on 15.27 Mc/s in particular was an improved signal in the evenings.

This station closes down on 15.27 Mc/s at 11 p.m. BST and starts up a few minutes later on 11.83 Mc/s, where he is generally a noticeably poorer signal.

On Monday, VQ7LO was quite a fair signal on 6.08 Mc/s at 8.10 p.m., with a "Sea-Shanties" programme of gramophone records, and Bucharest was also a good signal on 6.1 Mc/s, but accompanied by a slight heterodyne. At 10.30 p.m. this station broadcast a news bulletin in English.

Erratic conditions were experienced on W3XAL on 17.78 Mc/s on Tuesday evening, July 21st, this station at times being quite good, but normally only poor to fair, and it was inaudible on the Wednesday.

Thursday, July 23rd, saw the appearance of Podëbrady OLR in the short-wave firmament, and this new 34-kW transmitter tested on three frequencies, 6.115, 11.76, and 15.23 Mc/s, between 8 a.m. and 8 p.m., changing frequency every 30 minutes. All the frequencies were well received, but there was considerable interference between DJD and OLR on 11 Mc/s owing to Podëbrady being about 7 or 8 Kc/s too high in frequency in this case.

Further tests were made between 8 p.m. on Friday, July 24th, and 8 a.m., Saturday, July 25th, and in general the 15.23 Mc/s frequencies were the most satisfactory.

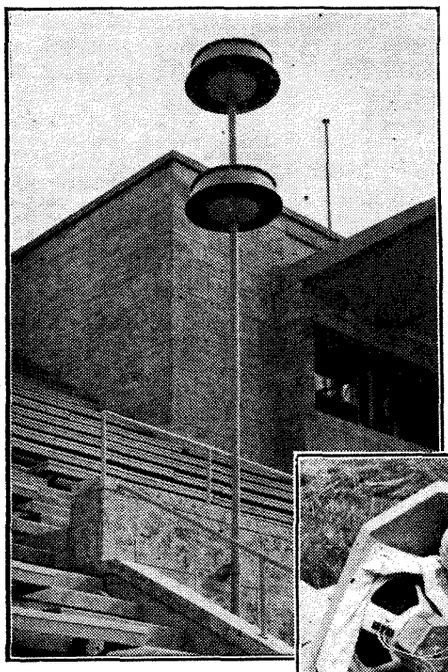
The best results on 15 Mc/s for some time were obtained from W2XAD, W2XE and W8XK at 10 p.m. Friday, July 24th, when all these transmitters had fairly good programme value; W3XAL was also better than usual when signing off at this time.

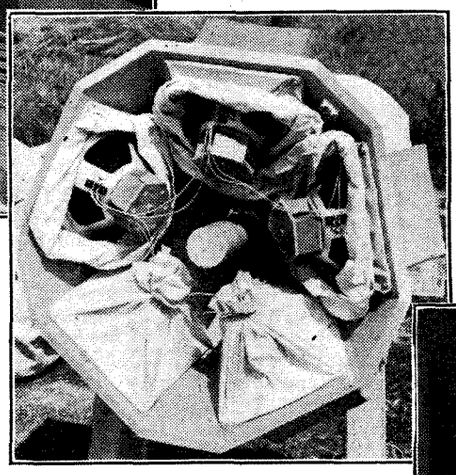
In closing, it has been noted that sunspot activity during the last few days has been small, and, probably in consequence of this, W1XK has again begun to put in an appearance during the mornings on 9.57 Mc/s.

ETHACOMBER.

Loud Speakers at the

NEW TYPES TO MEET THE SPECIAL REQUIRE



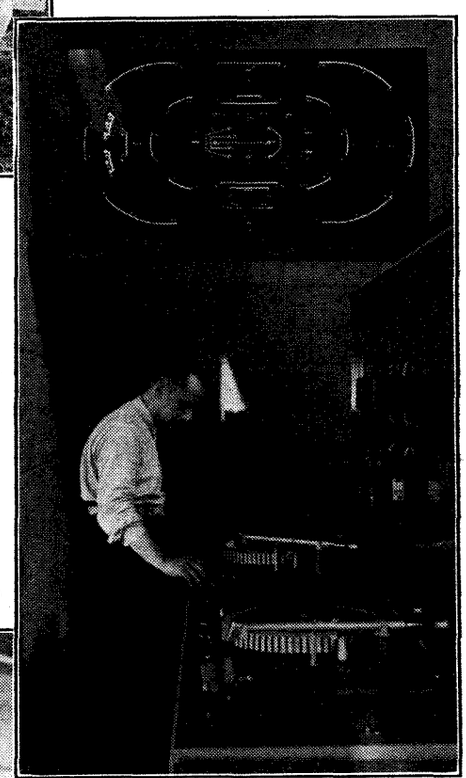


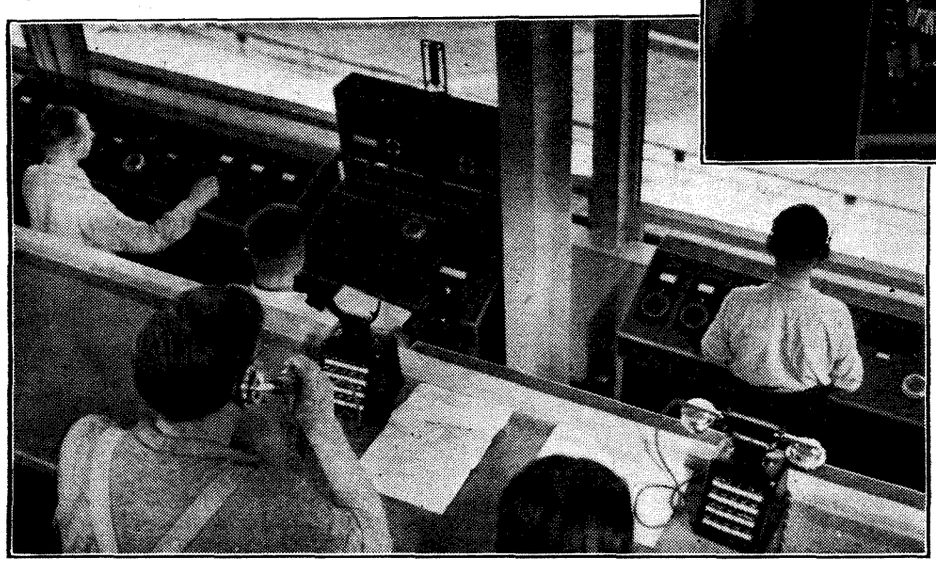
(Above) The latest Telefunken "dipole" loud speaker assembly, which is phased to cancel radiation in a horizontal plane. Echo effects in the Stadium as a whole are reduced without affecting the results as far as adjacent listeners are concerned. (Right) Interior of one of the units.

AUDIENCES of to-day must indeed be very different from those who assembled in the sports arenas of Ancient Greece to applaud the champions' efforts and to witness the dramatic action on the open-air stages. In olden times neither microphones nor loud speakers provided the onlookers with the latest results, nor could they amplify the voices of the masked actors.

At the Olympic Games at present taking place in Berlin uniform distribution of sound in the great Olympic Stadium, on the Parade Ground, in the Swimming Stadium, on the Marathon course, at the regattas in Grünau and Kiel, and on the various hockey, football, and indoor sports grounds is an essential requirement, as is the sound amplification for the Dietrich Eckart Open Air Theatre.

The mass meetings organised by the Nazi Party during the last three years have made it possible for those concerned in the development of public address to produce instruments and to make experiments which, they claim, have advanced the technique of public address in Germany beyond the present standard in other countries. However this may be, the Germans have certainly made valuable contributions, and their latest apparatus is highly interesting.





(Left) General view of the sound control room at the Olympic Stadium, Berlin. (Above) Turntables for supplying music during the intervals. The map above the operator's head shows automatically the loud speakers and microphones in circuit at any given moment.

Uni-directional, omni-directional, and "dipole" loud speakers—an entirely new type—are used at the various meeting-places of the Olympic Sports. Eight complete systems, comprising microphones, amplifiers, control desks and loud speakers have been installed in the Reichs Sports Field, which includes the Olympic Stadium, the Swimming Stadium, the Hockey Ground, the Parade Ground, the Riding Field, the Dietrich Eckart Open Air Theatre, the Sports University, the Terrace Restaurant, and the crowd control installation for the Reichssportfeld electric railway station.

These eight sytems, employing over 100 microphones and about 250 loud speakers, have a power output of 10,000 watts, which is sufficient for an audience of over 600,000, distributed over an area of 350,000 square metres.

Public address apparatus has also been installed at the Regatta Course at Grünau, the Marathon Course on the Avus, the Cycle Racing Course, the Riding Ground at Döberitz, the Golf Links at Wannsee, four other sports fields, the Olympic Village, in five Youth Camps, and in the halls of the "Pergamon" and the Old Museum. The task of providing these sites with public address equipment was so great that Telefunken had to call in other firms to cope with the order.

The existing types of loud speakers were found inadequate in a number of cases, so that entirely new instruments had to be created to suit the acoustical properties of some of the buildings and grounds.

The loud speakers in the main stadium proved to be the most difficult problem. The omni-directional mushroom type of loud speaker could not be used owing to the lack of sound absorption caused by

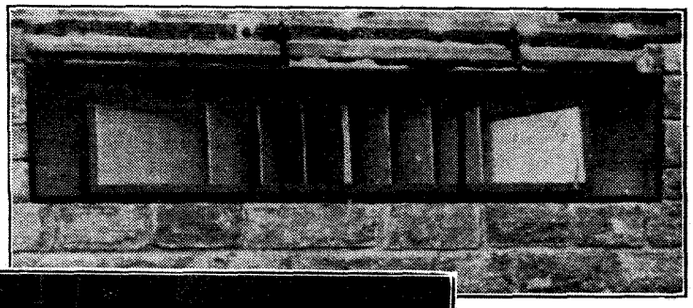
Olympic Games

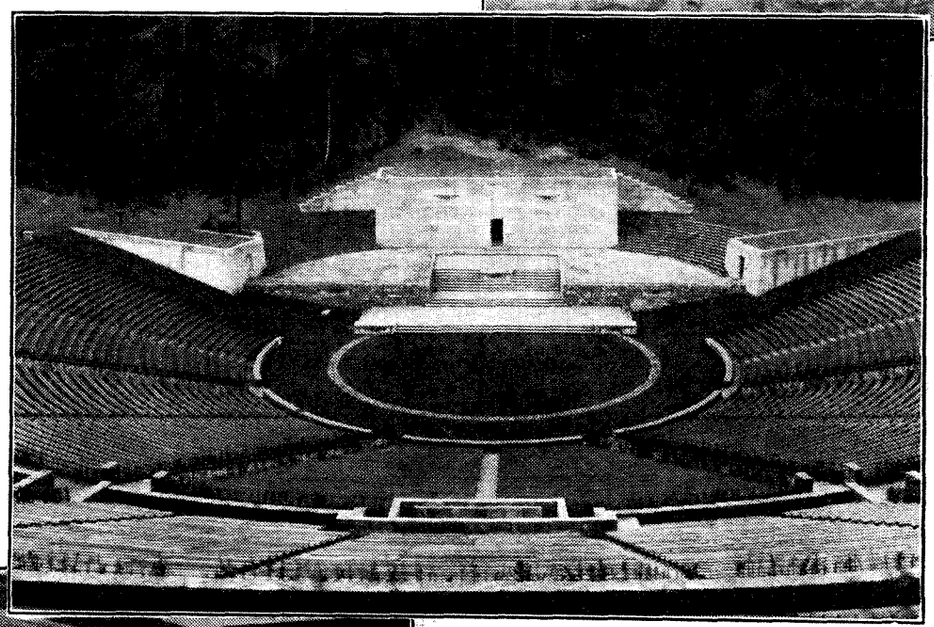
MENTS OF SOUND REINFORCEMENT

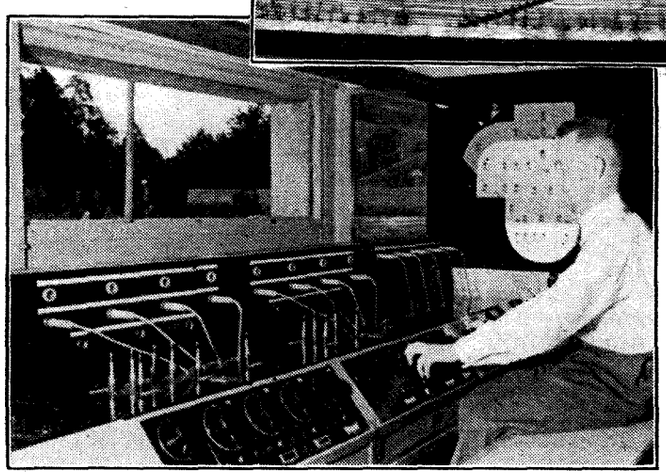
From Our Berlin Correspondent

the arrangement of the seats. This type of loud speaker is excellent on level ground but gives rise to natural echo in the stadium. Telefunken met the demand by creating the "dipole" loud speaker. Here one system of loud speakers is placed above the other and the diaphragms are connected to operate in opposite phase. By this means the medium and low notes cancel themselves in the horizontal plane between the two loud speaker systems, whilst persons either below or above the loud speakers can hear perfectly well. As this system of sound suppression by interference does not operate satisfactorily with the high notes, it was necessary to use their directional properties and to direct them sharply downwards. The loud speakers themselves consist each of five units, grouped around the centre post. A number of speakers with comparatively small diaphragms were found to be preferable for the rendering of intelligible speech to one single and larger unit.

At the Dietrich Eckart Open-Air Theatre the producer categorically declared against the erection of loud speakers among the onlookers, as this would entirely spoil the dramatic effect of the human voice proceeding from the stage. Directional loud speakers have therefore been used, and the control engineer who sits opposite the stage under the centre box and next to the lighting expert follows the script and switches microphones and loud speakers so that the amplified voice of the actor always emanates from the loud speaker projecting in the same direction as the person speaking. The openings of the loud speakers have been cunningly hidden so that they are not obvious to the audience.







The Dietrich Eckart Open Air Theatre accommodating an audience of 20,000, for which a special sound amplifying system has been devised. (Above) One of the concealed directional loud speakers and (left) the control room, which commands a view of the entire stage.

The third special problem was presented by the various ceremonies to be held in halls with indifferent acoustics. One, for instance, is to be staged in the main hall of a museum, which has a very long reverberation period. Here a large number of loud speakers will be hung round the walls and operated with low power. Telefunken had to produce what they term a "pocket-book" loud speaker for this purpose. It is quite flat and entirely unobtrusive.

One of the greatest difficulties in providing suitable loud speakers was the fact that artistic considerations came first and purely technical requirements second. In many cases a large baffle speaker would have been ideal, but would have spoilt the view for the onlookers as well as the general effect.

It seems unfortunate that, in spite of all the work and the excellent results which these loud speakers achieve when transmitting speech, they should have such a pronounced "tinny" sound for music. Speech being the more important in this case, music seems to have been sacrificed except in the case of the new "high-note" mushroom speakers.

As far as speech is concerned, Telefunken have certainly made great strides towards a complete solution of the problem, especially in view of the difficult architectural and artistic requirements; as for music, the big loud speakers hidden away in the trees behind the stage in the Dietrich Eckart Open Air Theatre seem, for my taste, to be the only really satisfactory ones. This word of criticism will not, I hope, detract from the appreciation of the really interesting improvements which have emerged under the stimulus of the Olympic Games.

One of the Telefunken omni-directional mushroom loud speakers with the lower casing dropped for inspection. These speakers, which are used in all the open spaces, now include high-frequency units extending the response to 10,000 cycles.

The Home Laboratory

IV.—A DYNATRON OSCILLATOR AND OTHER THINGS

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

FOR versatility a dynatron[1] test oscillator is hard to equal in the radio laboratory. Examples of its uses are: matching coils and condensers to high accuracy for ganged circuits; measuring or comparing the dynamic resistances of tuned circuits; testing HF chokes for mistuning and absorption over the band of working frequencies; testing samples of insulating materials for HF loss; generating oscillations of any frequency, radio or audio; and measuring the characteristics of aerials.

For many of these purposes an ordinary valve oscillator could be used, but the dynatron has the advantages (1) that a reaction coil or tapping is unnecessary and therefore oscillation can be set going in any coil even though it may be totally screened and inaccessible except for its two end connections; (2) that the resistance against which oscillation can be maintained is under easy and precise control by varying the grid bias; and (3) that the frequency of oscillation is remarkably independent of operating voltages, etc. Disadvantages are not serious and consist chiefly of the fact that unless one happens to acquire an exceptionally good valve (and they vary rather unpredictably) it may not be possible to get very "difficult" circuits (such as ultra-short wave) to oscillate. I have not come across any valve to compare with the Mazda AC/S2 for dynatron properties; most samples of this type are amply effective.

Resistance : Positive and Negative

To understand how the dynatron can be used for the various purposes suggested, it is necessary to visualise it in the circuit as a *negative* resistance, the amount of which can be conveniently controlled by varying the grid bias. Incidentally, an almost unique feature of the dynatron is that the control grid is not subjected to any oscillatory or "signal" voltage, but is kept at a steady bias voltage that acts as a throttle. When coils and condensers are put together to form a tuned circuit they are equivalent to a very high positive resistance at the frequency to which they are tuned. The lower the resistance due to losses in the components, the higher is this so-called "dynamic resistance." Using very efficient components it is possible to make it several hundred thousand ohms, while with poor components it may be only tens of thousands. If there were no losses at all the dynamic resistance would be infinity, but this can be achieved only by neutralising them by means of negative resistance, of which valve reaction is the most familiar example. The dynatron is actually a rather simpler form of negative resistance, as the amount depends on the valve itself and not on external coil couplings or adjustments.

Now, this is where it is easy to get confused. When asked whether a resistance of $-100{,}000$ ohms or $-10{,}000$ would be the more effective for neutralising losses, it is natural to say "$-100{,}000$," and perhaps to add "of course!" But bearing in mind that a resistance of 10,000 ohms represents much heavier losses than 100,000, one can see that $-10{,}000$ must be a correspondingly more effective negative resistance to neutralise it. When calculating one must use the rule for adding resistances in parallel,[2] by which a combination of $+10{,}000$ and $-100{,}000$ gives $+11{,}111$ ohms—only a slight improvement on the original 10,000. The negative resistance of a dynatron when it is given such a large negative bias as nearly to cut off its current is nearly infinity; so it is capable of neutralising only those circuits which are already extremely low-loss. As the bias is reduced, the negative resistance falls, giving correspondingly greater neutralising ability; but one has to be careful not to allow the screen current to rise excessively, or the valve may lose some of its valuable dynatron properties. When neutralising "bad" circuits, then, do so for as brief a time as possible; preferably just a "spot reading." The AC/S2 will go to $-10{,}000$ or even $-5{,}000$ ohms, but be careful about letting the screen current exceed about 7 mA.

THIS instalment deals with the construction and use of the dynatron oscillator, a simple and inexpensive but extremely useful piece of apparatus for the experimenter.

When the positive resistance of a tuned circuit is fully neutralised, oscillations set up in it continue indefinitely. If the grid bias of the dynatron is further reduced, so that the resistance is more than neutralised, the amplitude of oscillation increases until it sweeps round the bends of the valve characteristic curves, so bringing the negative resistance to a balance once more. This has at least three bad results: (1) it causes the valve to take an unnecessarily high current, (2) it produces strong harmonics in the oscillation, and (3) it causes the frequency of oscillation to depart from that which is determined by the capacity and inductance of the components. Operating Rule No. 1, then, is to work with the grid bias *just* on the right side of the oscillation point.

Estimating Circuit Losses

Any increase in the losses of the circuit necessitates reduced negative grid bias to bring the valve to the oscillation point. The bias voltage (taking care to keep all other working voltages constant) is therefore a measure of the circuit losses or resistance. The frequency at which the circuit oscillates depends, of course, on the capacity and inductance. *These two facts form the basis of all dynatron tests.*

The method in all cases is to compare one circuit or component with others. If the actual values of some are known, therefore, they can be used as standards to measure the unknown. As an example of how the dynatron is used in practice, suppose it is required to find the properties of an HF choke at a certain frequency. The dynatron is used to set a tuned circuit in oscillation at the appropriate frequency, and this oscillation is picked up on a nearby receiver which can be used to detect the exact oscillation point adjustment. Then the choke is connected in parallel with the tuned circuit. Two effects will be noted. Oscillation will probably be stopped, which necessitates a certain amount of bias reduction. When it is restarted, the frequency will be found to have shifted, which in turn necessitates tuning condenser adjustment to restore it.

The first of these effects is due to loss introduced by the choke, and the second is due to reactance. Both of these effects should be very small in a good choke, but most samples exhibit considerably increased effects at particular frequencies.

[1] For working principles see "The Dynatron Simply Explained," on page 132.—ED.

[2] $\frac{R_1 \times R_2}{R_1 + R_2}$

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One megohm and 1 m-mfd. are satisfactory but by no means record figures; results as bad as 30,000 ohms and 15 m-mfd. are not unknown. It is easy to compare one choke with another by noting the respective readjustments required to restore oscillation and frequency to the original condition. The actual values of equivalent resistance can be measured by substituting small composition resistors of the usual type (which can be relied upon to stick to their DC values up to high frequencies—20 Mc/s or thereabouts) and comparing the bias adjustment. Similarly the equivalent capacity can be measured if the tuning condenser is calibrated. Whatever capacity has to be taken out on the tuning condenser is, of course, equal to that put in by the choke. A *reduction* in tuning capacity to restore the original frequency after the choke is connected shows the reactance of the choke to be *capacitive;* the reverse shows it to be inductive.

It ought to be fairly obvious how similar methods can be adopted for other measurements. The matching of coils and condensers is done by changing over from one to the other and adjusting them until the frequency is the same for all. As a difference in frequency of a few cycles per second can easily be detected by the change in the beat note between dynatron and receiver, it is clear that more than ample accuracy of comparison is provided. The important practical point to observe is that in changing over from one to another there must be no appreciable difference in the lengths and dispositions of the connecting leads. With this object in view they should be kept short and straight. Crocodile clips are useful for easy change-over.

Comparison of the dynamic resistances of tuned circuits is quite simple, but it may be worth noting that the circuits being compared may each be connected in parallel with a permanent standard circuit adjusted to the same frequency—in which case numerical comparison can be established by substituting known resistors—or they may themselves form the sole oscillating circuit. The ability to measure iron-cored and screened coils, to which it is difficult or impossible to couple test coils, puts the dynatron method ahead of others. It need hardly be mentioned that when the coils are *not* completely screened it is essential to put them well apart, or at right angles, so that they do not couple.

The losses introduced into tuned circuits by such things as valve holders, screens, insulation, or even working valves, can be estimated in a similar manner. To test insulating materials, they may be clamped between flat metal plates to form a condenser. The loss due to such a condenser is compared with that due to the same area and thickness of another material.

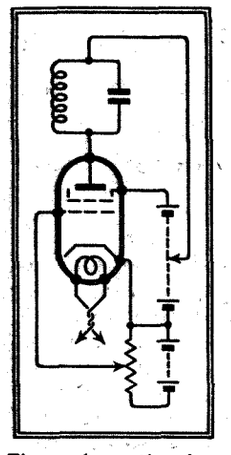
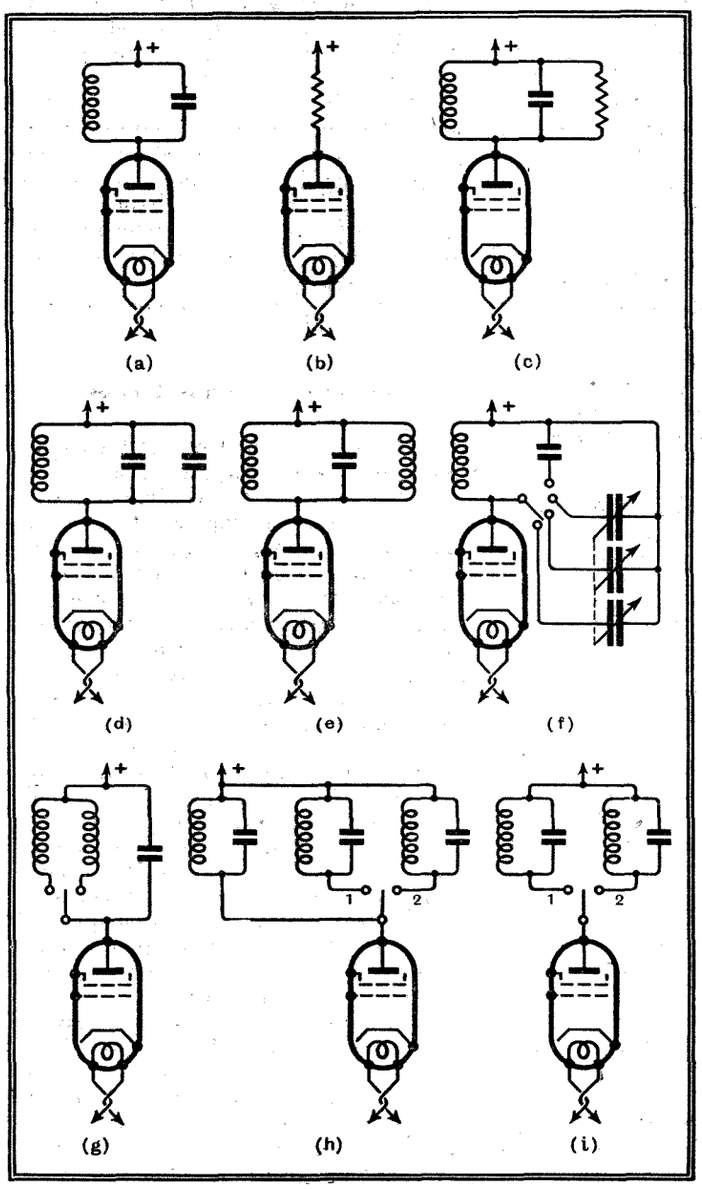


Fig. 2 shows the simplest dynatron system, but . . . (see Fig. 3).

Having gained some idea of how the dynatron is applied, we may consider the best form of unit for laboratory purposes. In essence the dynatron circuit is as simple as is shown by Fig. 2; in practice it is desirable to elaborate slightly. For one thing, by-pass condensers ought to be included so that HF currents are provided with direct paths instead of having to wander through batteries, etc.



THE DYNATRON AND ITS USES.

Fig. 1.—Diagram (a) is the fundamental anode circuit of a dynatron oscillator, and at the frequency of oscillation is equivalent to (b). If a resistance is joined in parallel, (c), the total equivalent resistance is reduced, necessitating reduced grid bias to maintain oscillation. If a capacity is joined in parallel, (d), the standard capacity has to be reduced to restore the original frequency; but if an inductance is connected, (e), the standard capacity must be increased. These tests are used to determine the nature and amount of a component such as a HF choke, which ordinarily is equivalent to a small capacity in parallel with a high resistance. For comparing the sections of a gang condenser, circuit (f) is used; the standard condenser need not be included unless it is desired to measure the capacity of the gang sections. Coils are compared as at (g), and complete tuned circuits compared with one another and with the standard as at (h); but if merely comparison with one another is desired it may be simplified to (i). Although a switch is shown to indicate a change-over, this does not mean that it is the best way of doing it in practice; clips are better.

Practical Dynatron Unit

As regards power supply, the heater of the AC/S2 takes the usual 4 volts 1 amp., so is most economically fed from AC; but where there is none it may not be unreasonable to devote a largish 4-volt accumulator to the job. Two-volt battery tetrodes *can* be used, but their dynatron properties are generally not very good. Where AC is available there is a choice between running the heater from a small 4-volt transformer and the other supplies from batteries, or an all-AC drive. If the AC is rectified and smoothed it makes rather a big affair of it. Semi-battery operation is cheap, because of the low current consumption; and the supply is steady. But if the apparatus is used infrequently it is likely that when it is needed the battery will be run down, and decidedly *not* steady. A useful and adaptable compromise will now be described in detail, with a switch for changing between battery and *raw* AC. The latter requires no rectifier or smoothing circuits, is always ready for use, enables lower negative resistances to be obtained without risk to the valve, and can be heard with a non-oscillating receiver. But it gives a rough note which is not so euphonious, and comparison of bias is not so accurate or convenient. Readers who wish AC only or battery only can omit the parts that do not interest them.

The full circuit is given in Fig. 3; the construction leaves considerable scope for individual taste or facilities, but a mere "breadboard" layout is quite permissible.

The transformer is a special one supplied by Sound Sales, giving 4 volts 1 amp. and 100 volts 40 mA.

The by-pass condensers should be non-

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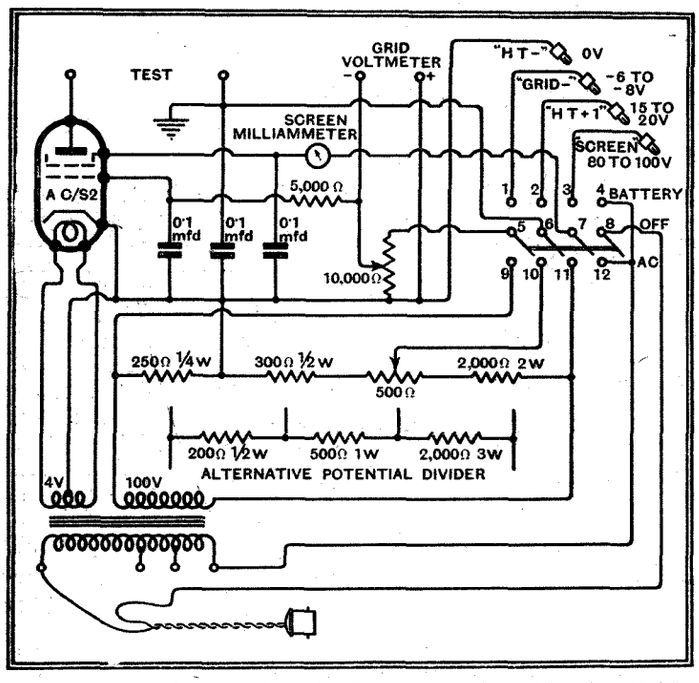
inductive and mounted close up to the valve with short leads.

In series with the grid is a 5,000-ohm resistor to prevent excessive grid current on the positive swings. The grid potentiometer should be wire-wound and give consistent wiper contact so that close adjustment may be made. If the control is a sound one, pointer-knob settings may be used for comparative tests, but voltmeter readings are more reliable, and terminals are indicated for the purpose. But remember that when the voltmeter is withdrawn the bias rises. It is wise to withdraw a DC voltmeter when AC is being used; as, apart from no proper reading being obtainable, the "movement" is liable to be damaged by the vibration. An anode voltage control is shown on the AC side, but this (and also the tappings on the battery side) must be regarded as semi-fixed adjustments to obtain the best conditions in the first place, as, of course, grid-bias comparisons are upset if the other voltages are shifted. The anode voltage control is not absolutely essential, and an optional potential divider network for fixed anode voltage is illustrated. By the way, it is quite futile to attempt to derive the anode voltage—about 20 is usually suitable—from a high-resistance network. It is useful to have a milliammeter in the screen circuit to indicate when the unit is working and to give warning when the grid bias is reduced too far.



. . . Fig. 3 includes a number of refinements, and provision for all-AC and semi-battery drive. Two alternative resistance networks are shown.

For a preliminary test connect a coil and condenser to the tuned circuit terminals, switch to either AC or batteries, and when the valve has warmed up check that the screen current varies as the grid-bias control is rotated. As regards anode current, there is no need to be dismayed if it is zero or even a milliamp or so in the reverse direction. There is not likely to be any very noticeable jump in the feed current at the point when oscillation starts, so it is necessary to listen for it on a receiver. The raw AC note is audible in a superhet. or non-oscillating receiver, but for accurately judging the exact tuning point it is better for the receiver to be oscillating. If there is no receiver that can be made to oscillate, the same effect can be gained by tuning it to a not-too-strong station carrier wave. It is usually best to disconnect the aerial for this purpose and rely on stray pick-up. To check whether the dynatron signal is the fundamental or a harmonic, move the grid control some distance round and note whether the strength alters greatly. If it does not, except perhaps a jump very close to the oscillation point, it is the fundamental.

An Audible Note

It is easy to modulate the battery oscillation by a clear high note for superhet. trimming, etc., by connecting in series with the tuned circuit, on the side away from the anode, a 3-henry choke shunted by 0.01 mfd. (Fig. 5).

As accessories to the dynatron, you want a set of coils and a variable condenser to cover the whole gamut of frequencies in which you are interested. It is a good plan to make these the laboratory standards of inductance and capacity. As such they should be as well constructed as possible; particularly the condenser. A real laboratory condenser costs anything from about £4 up to a few hundred pounds, and unless one is very keen on this branch of the work even the minimum figure mentioned may be too high. In that case the best possible receiver tuning condenser should be selected, particular attention being paid to smoothness of rotation combined with mechanical rigidity. See that vanes are well centred and unlikely to warp; and that spindle play, either sideways or axial, is absent; also that there is no likelihood of slackness developing. The Cyldon firm specialises in the better classes of variable, and their catalogue should be consulted. The B.35, a 350-m-mfd. SLF type, was used in the original of the oscillator described. The scale should be fully visible and have space for marking additional calibrations as well as the usual 100 equal divisions. The Burndept "Ethovernier" is best for this purpose, but unfortunately is difficult to obtain now. A useful substitute is the B.T.S. drive. As need may arise for more than one variable condenser, it is a good idea to mount them on plugs, or on small panels fitted with slotted metal strips for screwing down to the baseboard.

The coils are, of course, of the plug-in type; Eddystone makes a complete set

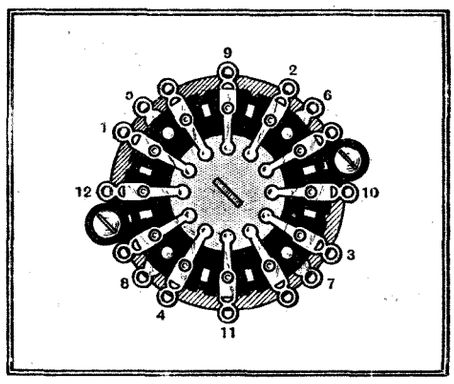


Fig. 4.—Connections of the switch used in the circuit of Fig. 3.

covering all the usual frequencies, with plugs to fit into a low-loss 4-pin valve-holder. Even the lowest wave coil (down to 7 metres) can be used in the dynatron oscillator. Two of the connections, leading to the reaction winding, are superfluous (except that the extra winding may be connected in series, one way or the other, to give different inductances); an alternative is to buy a number of empty coil formers and wind them as required.

The table gives winding data for a set of coils covering 9-3,000 metres with plenty of overlap between ranges. Oscillation was obtained over the whole of every range when tuned by a Cyldon B.35 condenser, and the figures in the Table refer to this combination.

The difficulty with coils is to calibrate them. If one had access to an accurate inductometer or bridge it would solve the problem. In the absence of this improbable facility the table of inductances given here will serve the purpose to a fair degree of accuracy, except perhaps for the slot-wound coils.

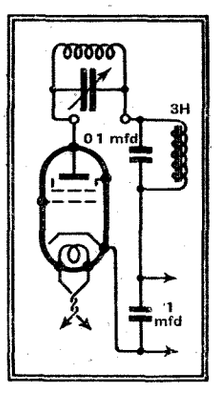


Fig. 5.—Modulation at approximately 1,000 c/s is obtainable by connecting an audio tuned circuit in series with the radio.

The condenser is not quite so simple. If it is impossible to borrow or otherwise obtain any accurately measured condensers by which to compare it, the only thing to be done is to assume the coil inductances to be correct, and to derive the capacities from the frequencies to which they tune. The frequency f is equal to $\frac{159,200}{\sqrt{LC}}$, where

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f is in kc/s, L in microhenrys, and C in m-mfds. The corresponding wavelength formula is $\lambda = 1.884\sqrt{LC}$.

Measuring Capacity Differences

The capacity calculated in this way includes that of the valve, the wiring, and the coil. In measuring unknown capacities by the substitution method described, one does not bother about the total capacity in the circuit, but works on the difference between two readings on the standard variable condenser—*before* and *after* connecting the unknown in parallel. They way to calibrate the variable is to tune in various stations on a receiver, adjust the dynatron oscillator to give "zero beat note," so that its frequency is exactly the same as that of the station, and then to calculate the corresponding capacities. Try to get points fairly well scattered over the range of adjustment of the condenser. Plot these capacities against divisions on the condenser scale; but as the actual values depend to some extent on the rest of the circuit and are not due exclusively to the variable condenser itself, the best thing is to make the known point nearest the minimum of the condenser a *zero point*, and to subtract the total capacity at this point from all the others. The resulting calibrations will indicate the capacity above that at "zero" setting of the condenser.

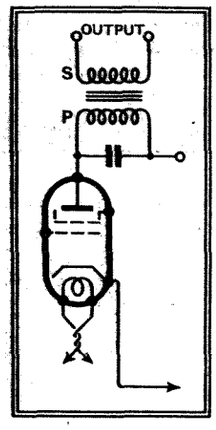


Fig. 6.—A quickly arranged audio source, making use of a step-down output transformer. For the higher audible frequencies it would be necessary to connect an air-cored choke in parallel.

Suppose, for example, that you wish to measure some small capacity, such as that from grid to all other electrodes of a valve. Connect the grid of the valve to the anode side of the standard variable condenser, and the other electrodes to the +HT side, by the shortest possible leads. Set the variable at "zero," and tune in a receiver to the dynatron oscillation. Remove the valve being tested, bring back the dynatron into tune with the receiver (readjusting the grid-bias of necessary) and the condenser reading then gives the required capacity.

Having had a little practice with a few examples of dynatron tests, the experimenter should have no difficulty in getting the hang of the thing and in making very accurate comparisons. Although radio frequency tests have been described, the dynatron is equally applicable to audio frequencies. A useful source of signals for testing the low-frequency end of a receiver can be made by connecting the primary of a step-down transformer—say a 10:1 or 20:1 ratio—in place of the usual coil. Various notes can be played by using different condensers in parallel. When just at the oscillation point this signal is very free from harmonics. The output can be taken from the secondary and applied to the gramophone terminals of the receiver; the signal voltage depends on the anode voltage, and reaches a maximum at half the screen voltage.

Reverting to laboratory accessories: although standards of resistance might appear a simpler matter than capacity and inductance, they are actually more difficult for the amateur to make. A most valuable piece of equipment is a decade box giving any resistance in single ohms up to 10,000, but if the accuracy and freedom from inductance and capacity is to be at all good it is a difficult and painstaking task. Readers sufficiently interested should consult books dealing fully with the subject. But a number of rough step-by-step boxes of resistors and condensers, and perhaps coils, are too useful to leave out of the smallest lab. One is always wanting to find the best capacity to use in a certain position in a circuit, and connecting separate condensers one by one is an unsatisfactory way of doing it. A small box with a rotary switch bringing into circuit in turn 2, 1, 0.5, 0.1, 0.05, 0.01, 0.005, 0.002, 0.001, 0.0005, 0.0002, 0.0001 mfd., or some such selection of condensers, is the thing to use. Similarly for resistors. Of course, they need not be highly accurate, but the makers sometimes supply such components to closer limits than usual if they are specially ordered.

INDUCTANCES OF COILS WOUND ON EDDYSTONE FORMERS.

Type of Former.	Wire.	Turns.	Spacing (turns per in.).	Inductance (Micro-henrys).	Waveband.*	
					Metres.	Frequency.
Threaded, Type 936 ..	No. 22	3	7	0.6	8.1–29.1	10.3–37 Mc/s.
„ „ ..	„ 22	4	14	1.1	10.7–37.5	8.0–28 „
„ „ ..	„ 22	6	14	2.0	14.6–50	6.0–20.5 „
„ „ ..	„ 22	16	14	8.0	29.7–102	2.95–10.1 „
Plain, Type 935 ..	„ 22 DSC	30	Close wound	31.5	58–200	1.5–5.18 „
„ „ ..	„ 30 „	100	„ „	255	166–580	516–1,800 kc/s.
„ „ ..	Eddystone Type BR main winding.			1,760	446–1,500	200–672 „
Slotted	„ „ GY „		„	7,240	910–3,060	98–330 „

* With Cyldon B35 condenser, 0.00035 mfd.

LIST OF PARTS FOR DYNATRON UNIT

1 Power transformer, 4 V 1 amp., 100 V 40 mA	Sound Sales
1 Potentiometer, 10,000 ohms	Reliance
1 Potentiometer, 500 ohms	Reliance
3 Fixed condensers, 0.1 mfd., non-inductive	
1 Resistance, 250 ohm ½-watt	Erie
1 Resistance, 300 ohm ½-watt	Erie
1 Resistance, 2,000 ohm 2-watts	Erie
1 Resistance, 5,000 ohm ½-watt	Erie
1 Valve	Mazda AC/S2
1 Rotary switch, 4-pole, 3-way	B.T.S.
1 5-pin Valve holder	
1 or 2 pairs of mounted terminals	Belling-Lee
1 Battery cable 4-way 30in. with wander plugs.	Belling-Lee
Baseboard, panels, main flex and plug	

A NEW SEASON'S IDEA

ONE firm has adopted a very sound idea for its new season's sets. In each of them the radio frequency, intermediate frequency, and audio frequency sections are built as separate self-contained units. The advantages of this system are obvious. Factory testing is very much simplified, since the units can be put through their paces individually before the finished set is given its final test as a whole. Should trouble occur after the set has been in use for some time the service man should be able to locate it rapidly, and if the customer wants the set back in the shortest possible time he can remove the defective unit in its entirety and replace it with another. The faulty unit can then be attended to at leisure.

If this system were elaborated and brought into general use it might go a long way towards ending the complaints that one hears about the delays and the expense that occur nowadays when some major repair is necessary. As matters are, the set is sent back by the dealer to the manufacturers, the customer having as a rule to pay carriage both ways. A week or two may elapse before its owner gets it back again. But if the set were constructed of units of the kind described and the dealer kept a floating stock of these, he would be able to put any set into working order again in a very short time, and the cost to the customer would be limited to the carriage to and fro of the defective unit and of the labour needed for putting it to rights.

THE TELEVISION FILM CAMERA of the German Broadcasting Company in use, with a telephoto lens, at the Olympic Games. The films were for subsequent transmission in the Berlin high-definition service.

Listeners' Guide for the

Outstanding Broadcasts at Home and Abroad

THE Promenade Concerts which enter upon their 42nd season on Saturday, are undoubtedly the outstanding feature of the week.

Throughout the season which runs until October 3rd Marie Wilson will lead the B.B.C. Symphony Orchestra of ninety players which will be conducted by Sir Henry J. Wood, who has wielded his baton on each successive "Prom" since 1895. On the opening night it is an inspiration to hear the welcome given to this eminent conductor who has done so much to bring classical music within the reach of all.

There will be broadcasts on no fewer than five days this week. On Saturday, the opening night, Liza Perli and Arthur Fear are the soloists, and this concert will be relayed at 7.55 and 9.55 (Nat.). On Monday, Wagner night, there will be a fifty-minute relay from 8 (Nat.) with Eva Turner and Arthur Carron as soloists. Part of the concert of William Walton's works on Tuesday will be broadcast from 8 to 9.40 (Nat.). The first part of the Brahms concert on Wednesday will be given Regionally from 8 to 9 and a further session from 10 to 10.55 will be broadcast Nationally. On this occasion Pouishnoff will be solo pianist.

From 8.50 to 9.40 on Thursday the Tchaikovsky concert will be broadcast, the soloists being Roy Henderson and Eda Kersey (violin). The first concert performance of John Greenwood's "Salute to Gustav Holst" will be conducted by the composer during this concert.

◆ ◆ ◆

YODELLERS

IN the Regional programme on Sunday from 5.30 to 6 will be included a relay of a Swiss concert from Bale by Emmy Braun and choir of yodellers, Guerrino Termignone, who will be playing the accordeon, and the "Drei Tannen" Rural Orchestra from Olten.

◆ ◆ ◆

JAMBOREE

FROM the grounds of Raby Castle, County Durham, tonight (Friday) at 9 (Reg.), will be broadcast the Scouts' Camp Fire Sing-Song at a jamboree which is to be attended by some 15,000 Rovers, Boy Scouts, Girl Guides and Wolf Cubs from all parts of the British Isles, Scandinavia and Holland. Included in this programme will also be a recording of the message given by the Chief Scout during his visit the previous day (August 6th).

When asked where he found the word "jamboree," Lord Baden-Powell said that he got the idea from the word "corroboree," an Australian native word for a large gathering.

TWO ISLANDS FEATURED

FROM the island of Ailsa Craig off the West Coast of Scotland, at the mouth of the Firth of Clyde, comes a programme at 8 (Reg.) on Saturday which will give listeners an idea of the life on this little island with its lighthouse and small community.

Rathlin, the lonely island off the coast of County Antrim, is featured on Monday at 9 (Reg.). Its 250 inhabitants live a very primitive life, there being no proper roads, no lighting and no pipe water supply. The programmes will consist of interviews with the islanders.

Both of these broadcasts will be carried out by wireless link.

◆ ◆ ◆

COLOGNE TO AUSTRALIA

THE story of the epic flight from Cologne to Australia of two young German airmen in May, 1932, has been dramatised by Gordon Ireland, an Australian, and entitled "Wings Over Westralia." The aviators were lost over the Timor Sea and landed about 100 miles from Darwin, their objective. They were stranded in the Bush and dying of starvation when found. It is the search for them which provides the action for this play.

Lance Sieveking has cast the play with authentic Australians to provide the correct accents. This will be broadcast on Tuesday at 8 (Reg.) and Wednesday at 8.40 (Nat.).

SIR HENRY J. WOOD conducting at one of last year's Promenade Concerts. This year he will again be in command. Inset is Marie Wilson, leader of the B.B.C. Symphony Orchestra.

GEORGE SCOTT-WOOD, here seen before the H.M.V. microphone, who, with his Six Swingers, will be heard on Saturday at 7.15 (Nat.).

◆ ◆ ◆

BRANSBY WILLIAMS

A ONE-MAN scena, entitled "Liverpool Landing Stage," will be broadcast for the first time in the solo programme of this great character-study artist on Monday at 9.15 (Nat.). With the assistance of the Effects Department for "noises off" Bransby Williams should produce a vivid sound picture.

◆ ◆ ◆

"BREACH OF PROMISE"

A DISCUSSION between two members of the Bar on this somewhat delicate subject will provide a thirty-minute broadcast from 8.15 on Thursday (Nat.). It will be interesting to hear the views of those whose calling brings them frequently into contact with such cases.

Week

BLACKPOOL

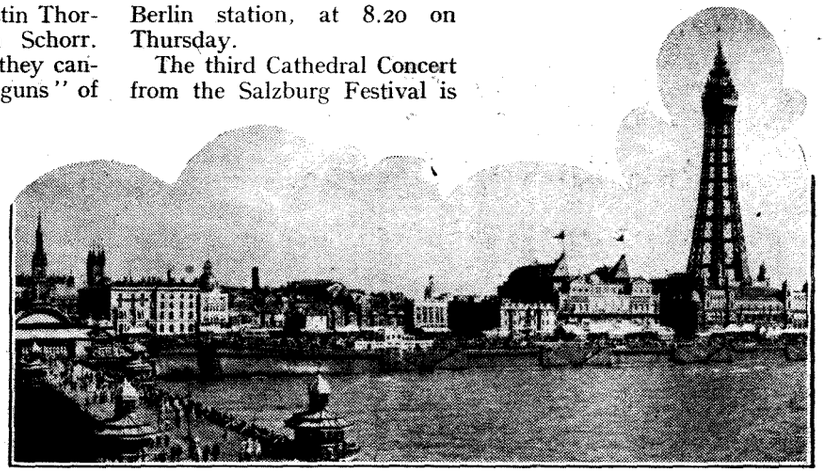
"TOP O' TH' TOWER" is the title given to the ambitious programme which emanates from this popular resort. It will include visits to such well-known places of amusement as the Tower, Palace of Varieties, Opera House, Empress Ballroom, Tower Ballroom and Pleasure Beach from which excerpts from shows in progress will be taken. This hour-and-a-quarter's programme is being presented at 8.45 on Thursday (Reg.) by Victor Smythe, and will include many well-known broadcasters.

WEST COUNTRY

A MUSICAL show for broadcasting with a strong note of burlesque is "The Bunch of Roses" by Diana Morgan and Michael Sayer, which comes into the National and Regional programmes at 6.30 on Wednesday. The title is derived from the name of the west country inn in which a mixed collection of people gather, including commercial travellers, highway robbers, surrealists, a detective, a waitress and the innkeeper.

Lotte Lehmann, Kerstin Thorborg, and Friedrich Schorr. Even those who say they cannot bear the "heavy guns" of Wagner as a whole, love this delightful opera with its rich and sunny melody.

From the Salzburg Festival on Tuesday the French Regional stations are taking Hugo Wolf's one and only opera, "Der Corregidor" (The Three-cornered Hat). The performance lasts from 7 until 10.



BLACKPOOL and The Tower which will be visited during the programme "Top o' th' Tower" on Thursday.

(Photo. by courtesy of L.M.S. Rly.)

PICCADILLY CIRCUS

FROM the Swedish stations on Saturday, from 8.15 to 9.15, comes an interesting talk under the heading, "A June Night on Piccadilly Circus," which will be illustrated by records of music and sound impressions of this hub of the British Empire.

CONTINENTAL CONCERTS

THE Grand Casino, Vichy, comes into the programmes being relayed by Vienna, Eiffel Tower, and Lyons PTT, when Pergolesi's "Stabat Mater" will be conducted by Josef Messner.

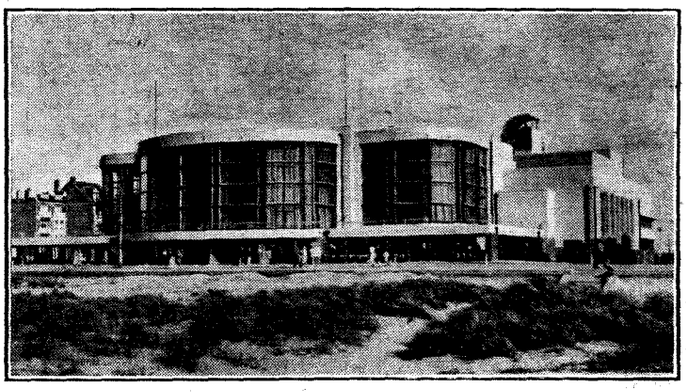
"DOWN SOMERSET WAY"

FOR those who are able to listen during the afternoon, an interesting item comes from Denmark at 3.45, when Inge Michelsen, a young Danish singer, will give a selection of Somerset folk-songs. It was whilst on holiday in England that Miss Michelsen was attracted by these quaint old songs.

SERIOUS JAZZ

ON Saturday, at 6, from the Danish stations, Vilfred Kjær will give his latest pianoforte jazz suite, "Black and White," in which he has endeavoured to give jazz a deeper meaning.

THE AUDITOR.



THE CASINO, KNOCKE, from whence a Johann Strauss concert, conducted by his grandson, Johann Strauss, will be broadcast at 9 to-night by Brussels No. 1.

OPERA FROM ABROAD

A COMPLETE recording of Rossini's immortal "The Barber of Seville" comes from Bucharest from 7.55 to 10.45 this evening (Friday). On Saturday the main opera event comes from the Salzburg Festival and is the performance of "The Mastersingers" which is being taken by Vienna and Radio-Paris, as well as by Czech and Swiss stations. The conductor will be Toscanini and among the soloists will be twice this week. On both occasions the conductor will be Karl Elmendorff, of the Bayreuth Opera. On Monday at 8.45 he will be conducting a symphony concert, while on Thursday at 6 Wagner's "Parsifal" will be given, both being radiated by Radio-Paris.

In memory of the opening of the Bayreuth Festival Theatre sixty years ago a Richard Wagner concert will be given, with Helge Roswaenge as soloist, from the Berlin station, at 8.20 on Thursday.

The third Cathedral Concert from the Salzburg Festival is

HIGHLIGHTS OF THE WEEK

FRIDAY, AUGUST 7th.

Nat., 5.25, Olympic Games Relay. ¶"La Vie Parisienne." 8, All Welsh Concert from Fishguard. ¶Pianoforte Recital: Freda Kindler.
Reg., Debroy Somers and his Band. 9, Scouts' Camp Fire Sing-Song. 10.30, Harry Leader and his Band.
Abroad.
Brussels No. 1, 9, Johann Strauss Concert from the Casino, Knocke.

SATURDAY, AUGUST 8th.

Nat., 3.55, Olympic Games Relay. 7.55 and 9.55, Opening Night of Promenade Concerts. ¶The Gershom Parkington Quintet.
Reg., 8, Ailsa Craig. 8.30, Music Hall. ¶Foden's Motor Works Band.
Abroad.
Rome, 9.30, Symphony Concert from the Basilica di Massenzio.

SUNDAY, AUGUST 9th.

Nat., 5.20, Chamber Music, Tatiana Makushina and the Pougnet-Morrison-Pini Trio. 7.55, Service from St. Martin-in-the-Fields. ¶Reginald King and his Orchestra and Leonard Gowings (tenor).
Reg., 5.30, Swiss Concert from Bale. ¶The London Palladium Orchestra. 7, Recital: John Goss (baritone) and Antoni Sala ('cello).
Abroad.
Kalundborg, 8.20, Classical Concert; conductor, Tuxen.

MONDAY, AUGUST 10th.

Nat., Peter Yorke and his Orchestra. 8, Wagner Promenade Concert. ¶Percival Garratt: pianoforte recital of his own works. 9.15, Bransby Williams.

Monday, August 10th (*continued*)

Reg., "Royal Hotel," musical variety entertainment. 9, Rathlin.
Abroad.
Strasbourg and Bordeaux, 8.45, Wagner Festival Concert from the Casino, Vichy.

TUESDAY, AUGUST 11th.

Nat., The Karl Caylus Players. 8, William Walton's Promenade Concert.
Reg., 8, "Wings Over Westralia." ¶B.B.C. Dance Orchestra. 9.40, Pianoforte Recital: Arthur Benjamin.
Abroad.
Radio Paris, 8.45, Montmartre Cabaret.

WEDNESDAY, AUGUST 12th.

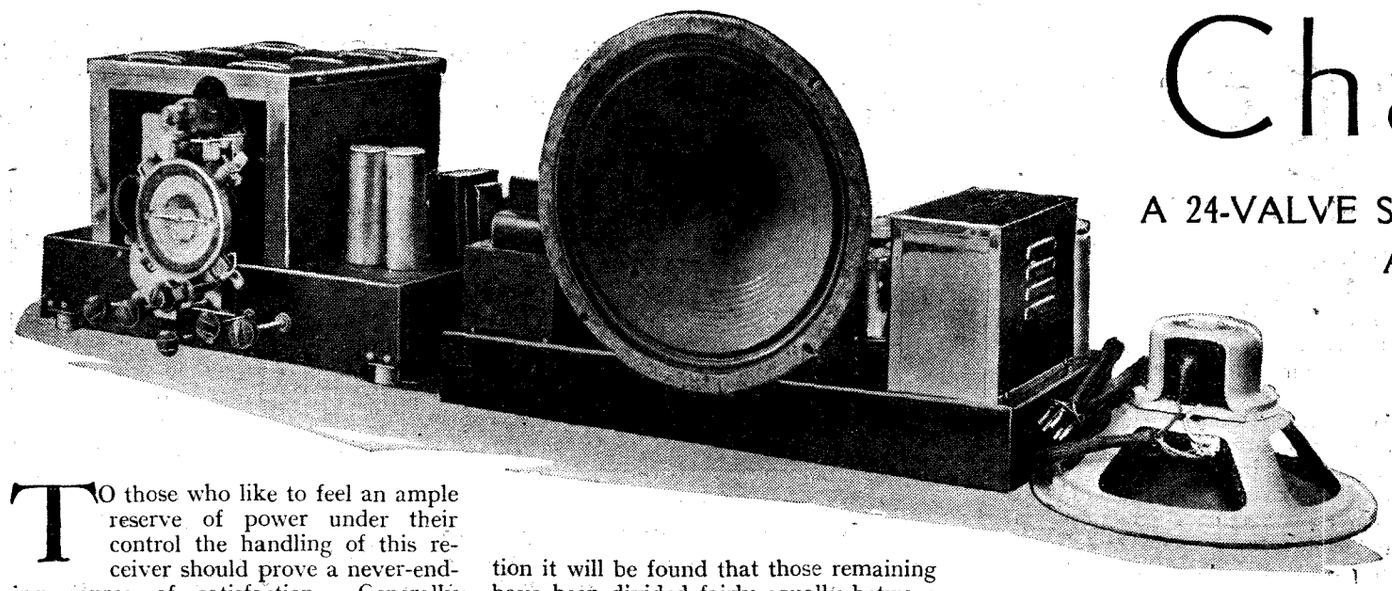
Nat., 6.30, "The Bunch of Roses." 8, Claude Hulbert and Bobbie Comber. 8.40, "Wings Over Westralia." 10, Part II of Brahms Promenade Concert.
Reg., 8, Brahms Promenade Concert. 9, The Salvationist Supplies Band and Samuel Worthington (bass). ¶Rawicz and Landauer.
Abroad.
Strasbourg, 8.45, Last Symphony Concert of the Season from the Orangerie.

THURSDAY, AUGUST 13th.

Nat., 8, Light Concert from Vienna. 8.50, Tchaikovsky Promenade Concert. ¶B.B.C. Orchestra (C) and Kenneth Ellis (bass).
Reg., 8.15, "Breach of Promise": Discussion. 8.45, "Top o' th' Tower." 10.30, Joe Loss and his Band.
Abroad.
Radio Paris, 8.45, Modern French Music.

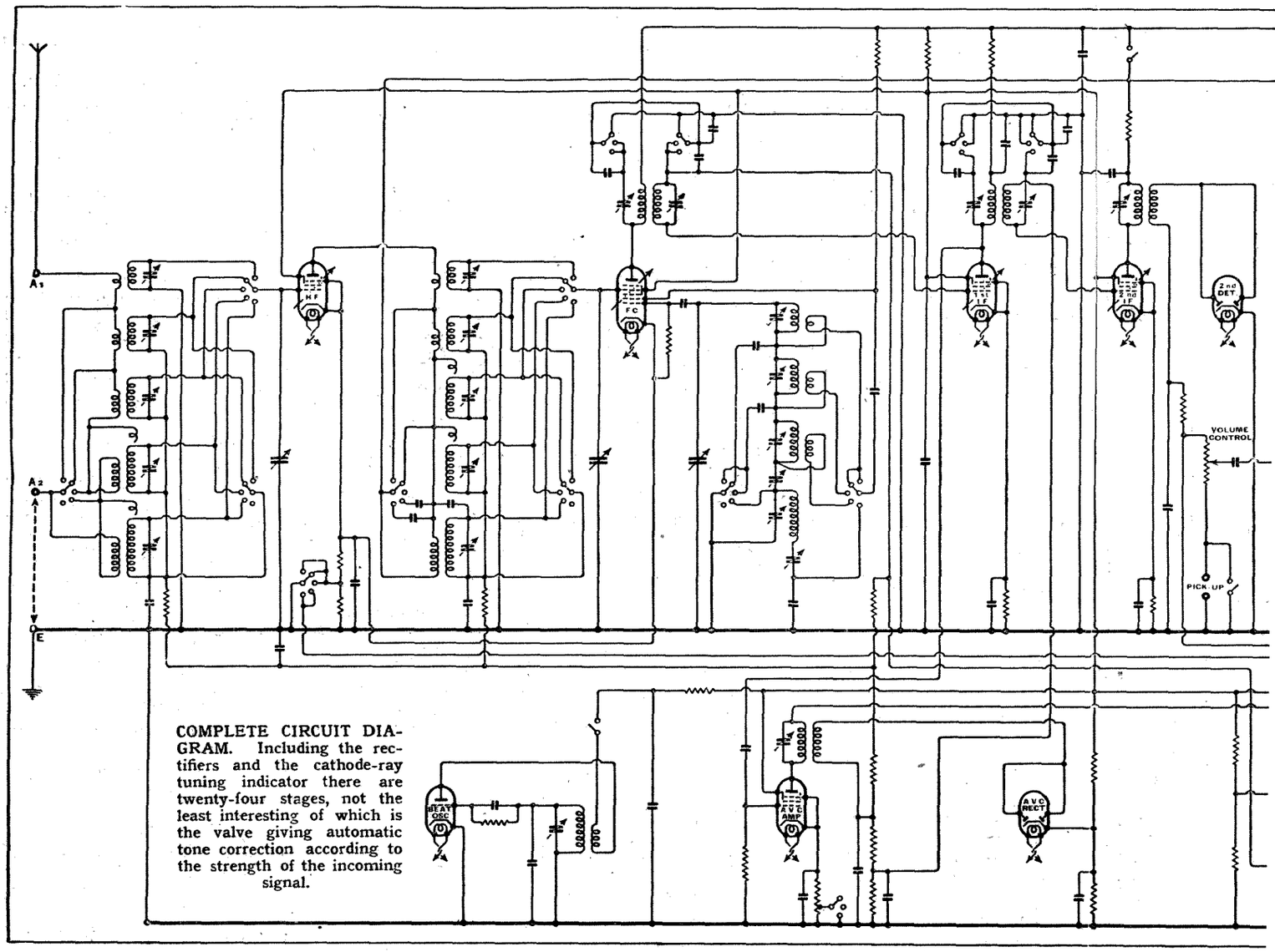
Chall

A 24-VALVE SUPERHE AND H



TO those who like to feel an ample reserve of power under their control the handling of this receiver should prove a never-ending source of satisfaction. Generally speaking, a receiver can be described as "powerful" either on account of its station-getting qualities or its acoustic output. The Challenger 524 merits this description on both counts, for after deducting valves of purely auxiliary function it will be found that those remaining have been divided fairly equally between the rival claims of signal amplification and power output. In the output stage alone there are no fewer than eight valves arranged in parallel push-pull, and the radio-frequency stages include such features as variable selectivity, a separate amplified AVC system, and an automatic tone-control valve giving bass compensation at low volume levels and cleaner reception of weak signals.

As might be expected in a set of this calibre, the first stage of the circuit is



COMPLETE CIRCUIT DIAGRAM. Including the rectifiers and the cathode-ray tuning indicator there are twenty-four stages, not the least interesting of which is the valve giving automatic tone correction according to the strength of the incoming signal.

enger MODEL 524

TERODYNE OF WIDE RANGE GH ACOUSTIC OUTPUT

devoted to HF amplification. There are five ranges covering wavelengths from 8 to 2,050 metres, and it has been arranged that the maximum amplification of the HF stage, as determined by the cathode bias resistance, shall be higher on the three short-wave ranges than on the medium and long waves. Transformer coupling is employed between the HF amplifier and the frequency-changer, which is a heptode. This valve is followed by two IF amplifiers operating at 465 kc/s.

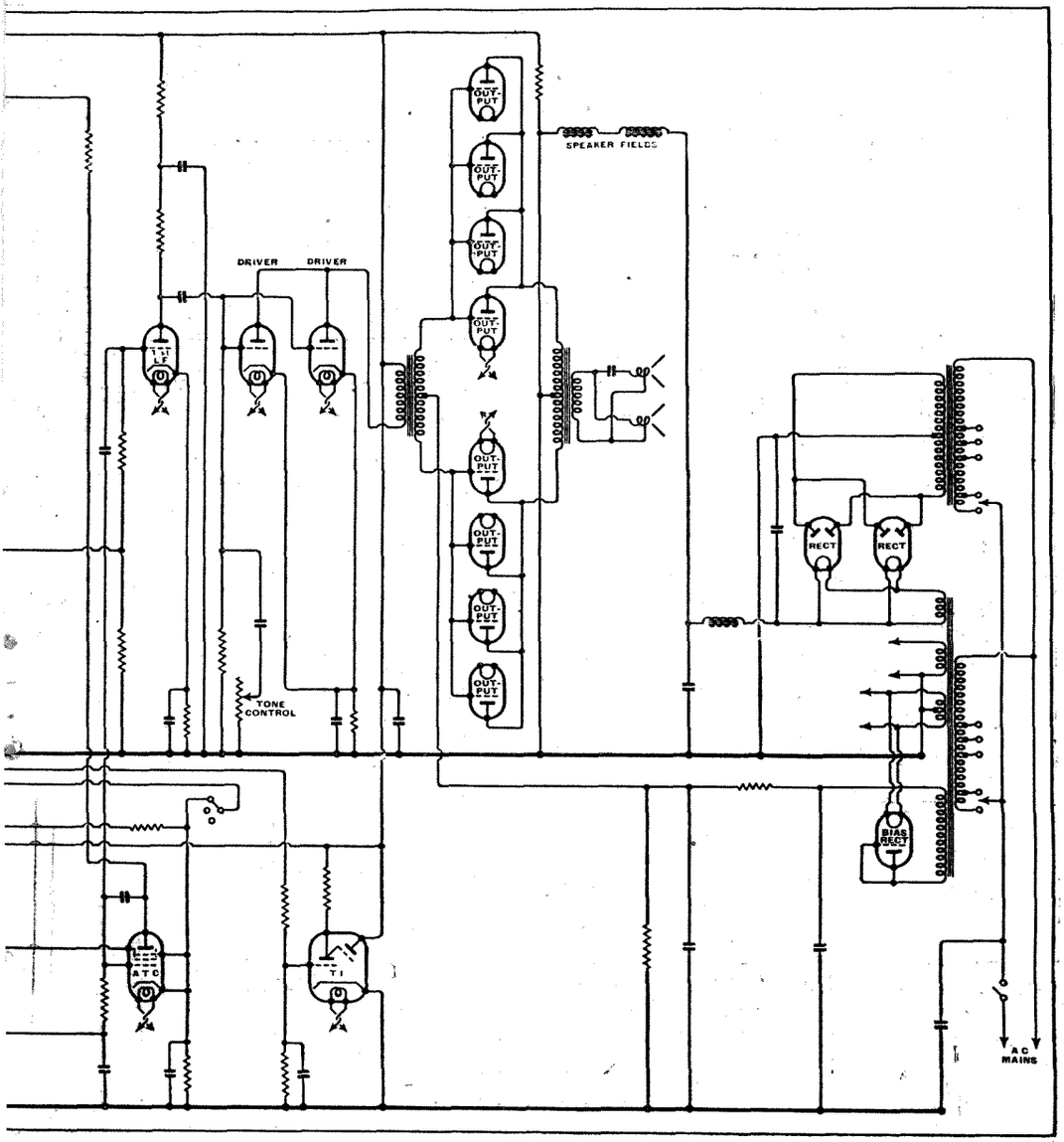
Of the three transformers associated with the IF stages the first two are arranged to give variable band-width by means of a three-position selectivity control switch. The variation of band-width is achieved by slightly mistuning the primary and secondary windings by small fixed capacities. The third IF transformer, which couples the second IF stage to the diode signal rectifier, has a single tuned circuit to correct the dip in the middle of the response curve of the preceding stage and so to give the required overall response.

A separate amplifier and diode rectifier are used to supply the AVC bias, the control EMF being taken from the anode of the first IF valve. Except on the ultra-short waveband, on which the HF amplifier and frequency-changer stages are not controlled, full AVC is applied to the first three stages. The second IF amplifier is fed with reduced bias from a tapping on the diode load resistance.

The cathode-ray tuning indicator, which incorporates its own triode amplifier, is controlled from the second IF valve.

Three LF stages follow the signal rectifier. With the first of these is associated the auxiliary automatic tuning control valve. This is a pentode with its grid

FEATURES.—***Type.***—*Superheterodyne receiver for AC mains.* ***Waveranges.***—*(1) 8-16 metres. (2) 16-57.5 metres. (3) 57-187 metres. (4) 187-555 metres. (5) 850-2,050 metres.* ***Circuit.***—*HF amplifier—frequency changer—two IF amplifiers—AVC amplifier—AVC rectifier—beat oscillator—cathode-ray tuning indicator—signal rectifier—first LF amplifier—automatic tone control valve—two parallel driver valves—eight output valves in parallel push-pull. Full-wave rectifiers in parallel—grid bias rectifier.* ***Controls.***—*(1) Tuning. (2) Waverange. (3) Volume control and gramo. switch. (4) Tone control and mains on-off switch. (5) Selectivity. (6) Beat oscillator switch.* ***Price.***—*£40.* ***Distributors.***—*Degalliers Ltd., 20, Polygon Mews South, London, W.2.*



filament circuit paralleled with that of the first LF amplifier. The resistance load in the anode circuit of the control valve causes the input capacity due to the so-called Miller effect to vary with the mutual conductance of the valve, which is in turn controlled by bias from the AVC line. Contacts associated with the wave-range and selectivity control switches are arranged to put the ATC valve out of action for high-fidelity reception on the medium- and long-wave ranges.

The second LF stage consists of two paralleled driver valves. These are necessary as under certain conditions power is taken by the input circuit of the output stage, which is designed to function under Class B conditions at high volume levels.

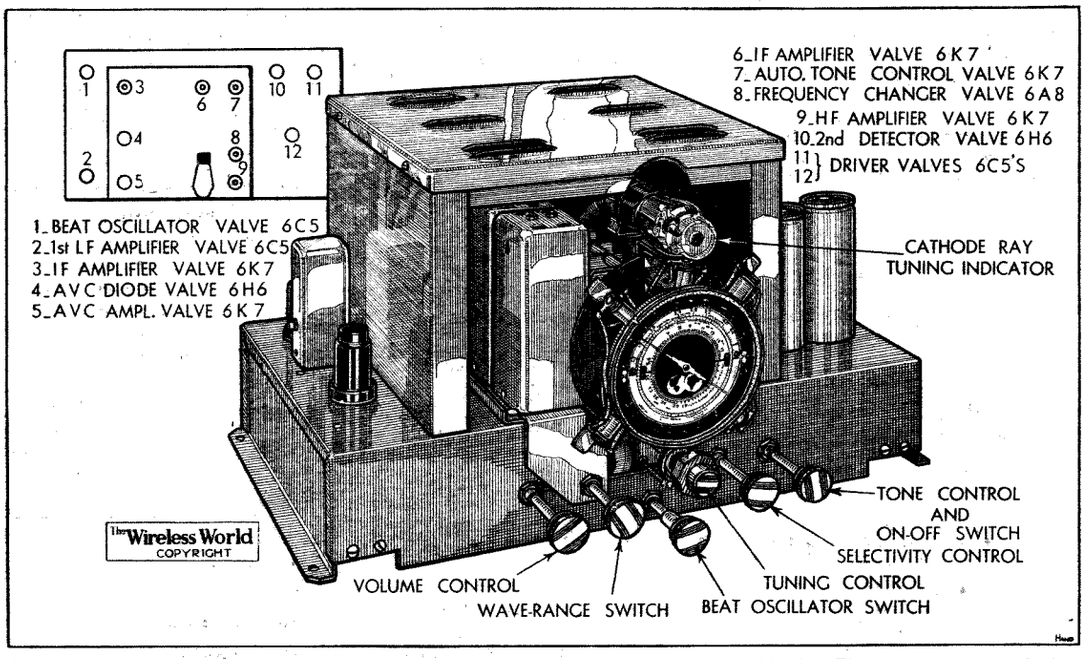
Power Supply

The power supply equipment is lavish and a total capacity of no less than 64 mfd. is distributed throughout the stages of smoothing. There are two separate mains transformers and a separate rectifier for supplying the bias to the output valves.

The controls are grouped round a "clock face" tuning dial, which is fitted with an impressive array of coloured pilot lamps to illuminate the five waveranges. The two-speed drive provides just the right ratios for normal broadcast and short-wave receiving conditions, and the mechanism is entirely free from backlash. Unexpectedly the mains on-off switch is incorporated in the manual tone control, and the switch at the minimum end of the volume control is used to mute the radio stages and to bring into circuit the pick-up sockets at the back of the chassis. The waverange switch is to the left and the selectivity control to the right of the

Challenger Model 524—tuning dial, while the sixth and final control immediately below is the beat oscillator switch. In general this feature will only be required when trying to locate a weak carrier on one or other of the three short-wave bands.

The cathode-ray tuning indicator immediately above the tuning scale is sensitive and indicates the position of exact tune with precision.



The central tuning unit is protected by a heavy-gauge chromium-plated shield. The arrangement of the controls is somewhat unconventional, the mains on-off switch being incorporated with the tone control, and the radio-gramo. switch with the volume control. Metal valves are used throughout the receiver chassis.

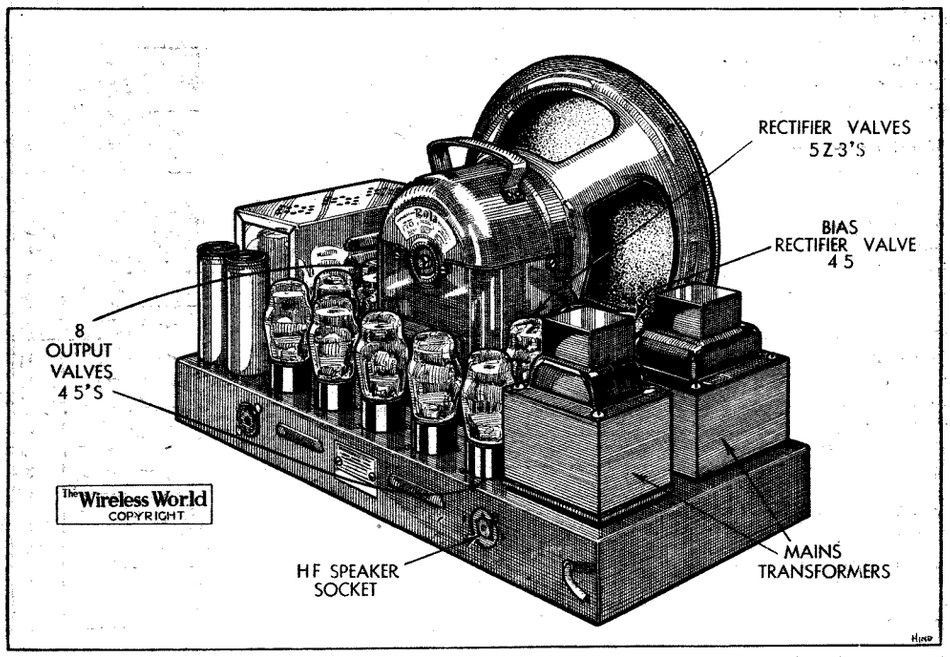
The range of the receiver fulfils the expectation resulting from an examination of the circuit. The medium broadcast band in daylight is as full of stations as the majority of sets under night reception conditions, and a really sparkling performance is provided by the short-wave ranges. It is safe to say that this set will receive anything that is going in the way of broadcast transmissions with the exception of the shortest television wavelengths. The signal-to-noise ratio throughout the entire range of the set is much above the average, there being little to choose in this respect between any of the wavebands.

The ultra-short waverange goes down to 8 metres, but does not get into its full stride until the pointer reaches a setting in the neighbourhood of 9.5 metres. Between this wavelength and 16 metres, that is to say, the point at which it overlaps the next highest scale, the full magnification of the circuit is obviously at the command of the listener.

Repeat points are entirely absent on the short waveranges, and there is no trace of second-channel interference and whistles on the broadcast bands. With the selectivity control set to give the narrowest IF band width, adjacent channel selectivity is possible between stations such as Cologne, North Regional and Sottens. With this setting the Deutschlandsender is also easily separated from its adjacent stations on the long waveband. In the vicinity of the local station on the medium waveband, however, the selectivity was not quite so good. There was clear evidence of overloading which resulted not only in apparent "double-hump" tuning, but also in some form of instability over a few degrees near the position of exact tune. A reduction in the length of the aerial cleared up this trouble, and the difficulty could easily be overcome by the addition of some form of local-distance control connected externally across the aerial and earth terminals. Another point to watch for in tuning the set is a slight shift of the centre of tuning when the variable selectivity control is changed. This would seem to indicate that the adjustment of the trimmers on the IF transformers required re-setting. On the short-wave ranges best results were obtained with the selectivity control in the high-fidelity position. On the selective setting some difficulty was experienced in placing the pointer on the position of exact tune owing to the narrowing of the response under the combined influence of the sharply tuned circuits and the amplified AVC control.

The set is provided with two loud speakers, one a twelve-inch "auditorium" type built into the chassis and the other a ten-inch subsidiary unit for reinforcing the high-note response. The reproduction is of the clear-cut quality which characterises a low harmonic content, and even at power outputs approaching the maximum available from the set the lower notes of the organ retain their smooth, round quality. The really excellent reproduction of pianoforte playing indicates good transient response, and the fact that the volume can be turned well up without producing a hard and edgy tone shows that the upper middle register is free from any serious resonances.

The chassis is divided into two parts, the receiver proper, and the power supply and output stages. The cores of the twin mains transformers are of unusually generous proportions, and the range of mains voltage adjustment is exceptionally wide, covering as it does voltages from 110 to 250. The power consumption is 250 watts and the total weight of the equipment is 95lb.



The eight valves comprising the output stage are mounted together with the rectifiers and the main loud speaker on a separate chassis.

Broadcast Brevities

NEWS FROM PORTLAND PLACE

Tricky Landline Work

NOT the least arduous job in connection with the broadcast from Beachy Head on Wednesday last was the establishment of the landline link between the lighthouse and the mainland. Normally, all communication with the shore is via motor boat to Eastbourne Pier, an hour's sailing distance away, and it was by this route that the commentator travelled. The landline, however, had to be lowered over the face of the cliff.

Stormy Weather

It so happened that the weather was exceptionally boisterous when the Post Office cable was being slung from the telegraph post at the cliff summit, 575ft. from the beach, and the installation engineers spent some hectic hours "hanging on by the eyebrows" until the cable was safely in position. Just another instance of the detail work which goes on behind the scenes of a successful broadcast.

B.B.C.'s Transport Fleet

The motor boat was a new form of B.B.C. transport. Motor vehicles already comprise quite an imposing fleet, and it may surprise many people to know that the Corporation owns nearly sixty of these, ranging from small pantechnicons for conveying orchestral instruments to light saloon cars used by programme staff and engineers for visiting outlying districts in connection with outside broadcasts. Some 50 per cent. of the vehicles are used in the London area.

Receivers on Ambulance Chassis

Probably the B.B.C.'s two heaviest vans are those containing the mobile transmitters used for field-strength measurements prior to the erection of a new transmitting station. The receiving apparatus employed for field-strength tests is contained in cars having special non-metallic bodies mounted on ambulance chassis, which have super-springing arrangements.

Regional Scheme Still Growing

THE "Regional Scheme," if such it can still be called, has no end, for as one station is completed plans are drawn up for the erection of another to cover some part of the country which experience proves is still not adequately served.

Time was when we thought that Burghead—that lone sentinel-like station nearing completion on the Moray Firth—would complete the B.B.C. chain and fill the cup of listeners' happiness; but long before the foundations were dug it was agreed that the South and West of England must have new transmitters as well.

That, however, is another story.

North Scottish: Opening Date

Burghead's opening date will be September 20th. The wavelength has not yet been officially announced; but, as the North Scottish transmitter will be, to all intents and purposes, nothing more than a glorified relay station, we may assume that synchronisation will be resorted to. With what station will it be synchronised?

Readers who can answer this question will have no difficulty in guessing the correct wavelength.

Gertrude Lawrence

ONE of the greatest international artists returns to the microphone on August 24th (National, 8.0 p.m.) and Regional (August 25th, 8.55 p.m.). She is Gertrude Lawrence, who will play the lead in the musical story, "Never Talk to Strangers," by Kenneth Leslie-Smith and Philip Leaver. The story begins on an Adriatic steamer, moves on to Trieste and Paris, and ends in the Customs House at Dover. The producer is John Watt. Gertrude Lawrence has been broadcasting since 1927, latterly with Noel Coward, with whom she went on tour last autumn in "To-night at 7.30."

News of the Week

Wireless Relays

THE Postmaster-General has received a deputation from the Relay Services Association of Great Britain, which placed before him certain points arising from the Government's decision to extend the existing licensing system for another three years. The Association is naturally up in arms against the possibility that existing exchanges may be compulsorily purchased by the P.M.G. in three years' time. The points raised by the Association were fully discussed, but the Postmaster-General, while promising to consider the views they put forward, said that he was not in a position to add anything to the announcement already made by the Government.

Demonstrations on 75 Centimetres

AT a recent radio exhibition in Geneva demonstrations were given of transmitters working on 75 centimetres using a little over half a watt input. It is reported that signals were clearly received at ten miles' distance. Power was obtained from a car battery, the voltage being stepped up by means of a vibrator and transformer in the usual manner.

New French High-powered Station Proposed

GRENOBLE is to be the venue of a super-broadcasting station of high power, according to a statement made by M. Pellenc, the Director of State Broadcasting. Already, it is said, engineers have arrived at the proposed site of the new station in order to make a preliminary survey. Although it is not intended to make this station the most powerful in France, it is said that at least it will be comparable with the most powerful existing ones. The exact power and other technical details have yet to be decided upon.

New Recording System

THE Philips-Miller system of sound recording has been installed at the Maida Vale studios of the B.B.C. The recording is done on a 17.5-millimetre film, perforated along one edge. These perforations are for the purpose of synchronising the sound with the picture film. The sound film is definitely not a photographic one, and is visible throughout the recording process. The system, which has a linear response of 30 to 10,000 cycles per second, was described in *The Wireless World* of February 28th, 1936.

The Institute of Wireless Technology

SPEAKING at the Annual General Meeting of the Institute of Wireless Technology the President emphasised the necessity of special training for television engineers, and pointed out that the Institute is the only professional body examining in television. He also reminded his hearers that the standard of knowledge necessary for servicing television receivers will be very much greater than that which has been demanded by ordinary broadcast sets.

Set Making in U.S.A.

AN important lecture comparing British and American methods of manufacture will be given at the Midland Hotel, Manchester, at 7.30 p.m. on Wednesday, August 12th, by Mr. J. B. Ferguson, who is responsible for the production of the well-known Ferguson brand of American receivers. Those interested are cordially invited to attend.

DUTCH TELEVISION. A directly scanned outdoor scene, transmitted by the Philips 405-line interlaced system. This untouched photograph, taken with a 2-sec. exposure, hardly does justice to the picture as it appears on the viewing screen.

The Dynatron Simply Explained—

—and, Incidentally, Most Other Sorts of Valves as Well

By "CATHODE RAY"

SOME time ago, when explaining the simplicities of Ohm's Law, I mentioned that there are some things, such as valves, that are not ruled thereby. If they were, valve characteristic curves would be superfluous. It would be necessary to know merely the resistance of the valve, from which the current for any HT voltage could immediately be calculated—as with any ordinary resistance. Fig. 1 gives the characteristic "curve" of a 5,000-ohm resistor, which shows what I mean by saying that it is too simple to take the trouble to draw. The one figure "5,000" tells the whole story. Applying 50 volts causes a current

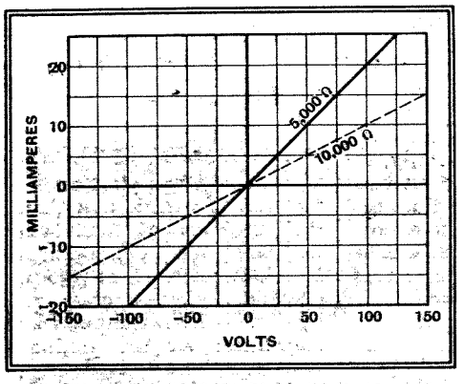


Fig. 1.—Characteristic "curves" of ordinary resistors. The full line is for a 5,000-ohm resistor, the dotted line for 10,000 ohms.

of 10 milliamps to pass; doubling the voltage doubles the current; reversing the voltage (−50) causes a reverse current (−10 milliamp.) to flow. That is simple Ohm's Law.

The dotted line is the characteristic of a 10,000-ohm resistor, and it will be noted that it makes its appearance as a slope of half the steepness of the 5,000-ohm line.

When a valve specification declares that the resistance (or impedance) is 5,000 ohms, it either implies or specifically states that this is so under some definite conditions—usually 100 volts on the anode and zero grid volts. When there are other electrodes—screens and so forth—their voltages have to be specified too.

Resistance and Impedance

Fig. 2 shows a characteristic curve, A, of a valve that is 5,000 ohms at the usual 100 and 0 volts. An ordinary 5,000-ohm resistor at 100 volts would pass 20 milliamps., as shown by the star on the diagram, and all other points would be on a straight line, B (which, of course, is the same as the full line in Fig. 1). But although our valve is 5,000 ohms at 100 volts, this does not mean that the corresponding anode current is 20 milliamps. It is probably a good deal less—perhaps about 10, as shown by the marked point on the curve A. According to Fig. 1 this would stand for 1,000 ohms. In what sense, then, can the valve be considered to be 5,000 ohms?

When a valve is in actual use, one is generally concerned with small changes in voltage, caused by a signal, above and below the point that is fixed by battery or power supply voltage. The important part of the characteristic curve, then, is the part in the immediate neighbourhood of the working point. Supposing for the moment that the working point happens to be at 100 volts and zero grid bias, the slope of the curve here is indicated by the dotted line C, and it is parallel to B. So just around the working point the valve behaves in the same way as a 5,000-ohm resistor *so far as small variations in voltage are concerned*. That is why 5,000 ohms is said to be the AC resistance or the impedance. The resistance, according to Ohm's Law, would be $\frac{100 \text{ volts}}{0.01 \text{ amp.}}$, or 10,000 ohms; and that is of interest when making the power supply arrangements. But it is not the figure to be used when calculating the amplification obtainable from the valve.

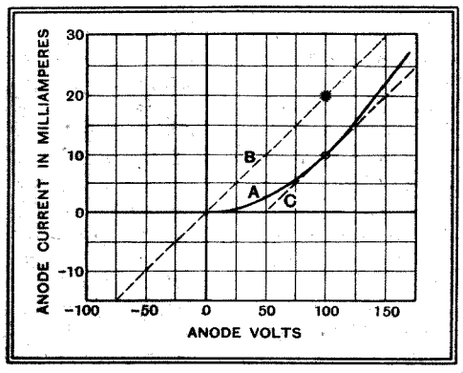


Fig. 2.—The line A is a typical valve characteristic curve. The slope at 100 volts is the same as that of the 5,000-ohm line B, but the current is only that corresponding to 10,000 ohms. The figure given in the valve catalogue is the AC resistance, 5,000 ohms.

Talking of amplification; in actual practice one would not use the valve with no grid bias, and probably the anode voltage would be higher than 100. It is perfectly clear from Fig. 2 that, if the anode voltage is altered, the slope of the curve, and hence the AC resistance, alters too. And if additional curves for other grid voltages were visible, they would show quite clearly the alterations in resistance caused by them. So when the valve leaflet says the resistance is so many ohms, this must not be regarded as a fixed fact independent of how the valve is used. In passing it may be mentioned that when a negative grid bias is applied to a valve it causes an increase in anode AC resistance that approximately offsets the decrease caused by an addition of μ times as many volts to the anode. For example, if our valve had a μ (amplification factor) of 15, and were worked with a grid bias of −3 volts, the working point conditions would be restored by adding 45 volts to the anode, making 145 in all. But it must be remembered that this is an approximate rule that is useful for most normal conditions of operating valves, and may cease to hold in exceptional cases.

Full and Partial Rectification

Before going on to look at one of the most interesting of these exceptions, just take note of what happens when the anode voltage is negative. There is no anode current at all, either positive or negative; there is no slope at all to the line, and that means that the resistance is infinite. If the valve is worked at the zero point, and an alternating voltage is applied, the positive half causes a positive current, the negative half causes nothing, so an alternating voltage produces a unidirectional current. That is rectification, and it occurs to some extent whenever the applied voltage covers conditions of varying AC resistance. In a valve the resistance varies most markedly around the zero point, which is consequently selected for intentional rectification; but unhappily it varies also to some extent throughout the range of possible operating conditions, so that rectification and consequently distortion are never entirely absent.

Another aside; all this talk about slopes of valve characteristic curves must on no account be confused with what is usually

The Dynatron Simply Explained—

understood by the term "slope" in such a connection, which, incidentally, has no more right to the exclusive use of the term than the matter I have just been describing. But there is a general agreement to understand by "slope" another characteristic of a valve—the mutual conductance—which is actually the slope of the anode current/*grid* voltage curve. As a matter of interest, the ratio of the two slopes is the amplification factor, μ.

The interesting irregularity to which I made reference is in the characteristic of the now disappearing screen-grid valve. The cause of its disappearance is this very irregularity, which its successor, the HF pentode, does not possess; but what renders the tetrode screen-grid valve less suitable for general use qualifies it for certain special uses.

The Negative Resistance Kink

The triode valve has a curve of the type shown in Fig. 2. As the anode voltage increases the line continues to rise upwards, getting straighter, until the filament can no longer supply the wherewithal for so much current, and the line bends over towards the horizontal again. The pentode is also curved, but with a different shape at the lower end (full line in Fig. 3). The tetrode is similar *at all anode voltages greater than the screen voltage,* but below this there is a curious dip (dotted line in Fig. 3). The thing that is really remarkable and special about it is that the line slopes down from left to right. This may not seem

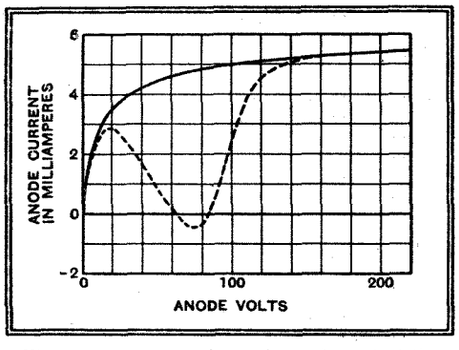


Fig. 3.—A pentode valve characteristic curve has the shape of the full line, being for most purposes an improvement on the dotted line, which is the characteristic of a tetrode (screen-grid valve).

to be anything to get excited about, until one begins to think it out. In almost every sort of resistance that can be thought of, whether it obeys Ohm's Law or not, an increase in voltage causes an increase in current, and a voltage does not drive a current in the opposite direction, like an obstinate mule. This backward sloping curve is really almost as phenomenal as a stream gaily flowing uphill. If an increase of V volts causes an increase of -1 amps, the resistance can only be regarded as $-\frac{V}{1}$; in effect, a negative resistance.

That may appear as easy to visualise as a mathematical imaginary quantity or a fourth dimension. Let us think it out a bit further. What does a resistance really amount to in practice? When one wants to heat a room by electricity, one does it by connecting a resistance across the supply circuit. The more resistance that a given current can be forced through, the more heat. When a transformer, motor, or any other electric power converter is wound with excessively thin wire for the purpose, the undue resistance causes the thing to overheat. Heat is the evidence of power being lost. Usefully lost, it may be, on a cold day, but lost nevertheless so far as the electric circuit is concerned.

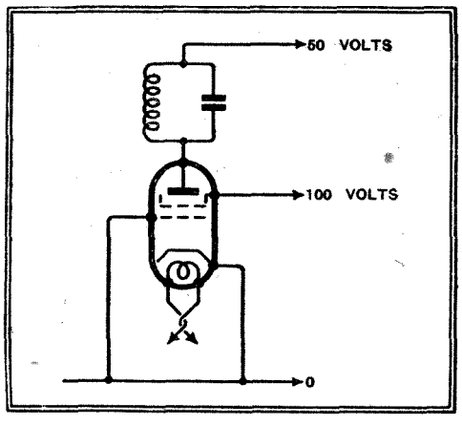


Fig. 4.—What oscillator circuit could be simpler than the dynatron?

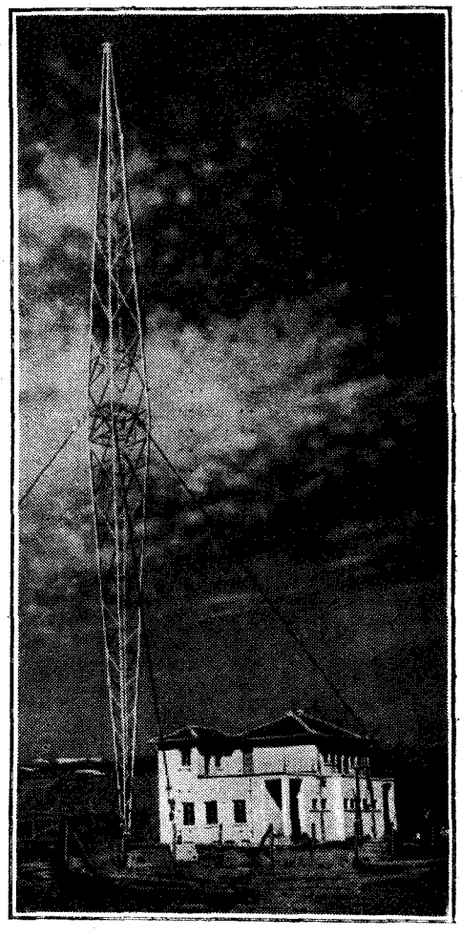
When the object is to use the electricity for driving a train, dusting the room, or making a loud sound issue from a speaker, loss of some of the electricity in the form of heat is wasteful, if not a good deal worse. So resistance is in the nature of a not-altogether-avoidable evil. Resistance in a valve absorbs some of the power with which that valve is entrusted. When the valve is connected across a tuned radio circuit, its resistance damps the circuit and makes it less responsive and selective. It is like a rusty suspension to a pendulum, or a dirty bearing for a hair-spring. When the resistance is infinite, that is to say when there is none at all (for explanation of this paradox see "Resistance—Meat or Poison," April 17th, 1936) the tuned circuit is free and undamped by any except its own internal resistance. And when the valve resistance is negative—? The only meaning that it can have is that instead of stealing power from the circuit it feeds power into it; instead of blunting the response to tuned signals it sharpens it; and, if the negative resistance is such as to outweigh the combined positive resistance of everything else influencing the circuit, the excess of power builds up continuous oscillations at the frequency to which the circuit is tuned.

So the tetrode, when suitably adjusted, can be made to improve the selectivity of a circuit, or even to generate oscillations in it. Used in this way, the valve is called a dynatron.

The Simplest Oscillator Circuit

As everybody knows, this is not the only way of causing a valve to generate oscillations, nor even the usual way. Any receiver with "reaction" will do it if the knob is turned far enough, although it is extremely unlikely that any valve therein is capable of being adjusted to any condition corresponding to a backward-sloping resistance curve. Instead, a coil in the anode circuit is coupled to one in the grid circuit in such a way that for currents or voltages *of the particular frequency to which these coils are tuned* the whole arrangement is equivalent to a negative resistance. This is not obvious, and I am not going to stop to explain it, but there are two things to be noted. One is that the negative resistance of a back-coupled valve is confined to a particular frequency (the resistance being positive so far as other currents are concerned), whereas the dynatron negative resistance is general; the other is that an ordinary valve requires reaction coils, or tapped coils, or double condensers, or some such complication before the negative resistance effect can be obtained, whereas the dynatron works on anything that is connected in the anode circuit. So any coil of which only the two terminals are accessible can be "oscillated" merely by connecting it to the dynatron. This is very handy for testing purposes or whenever an oscillator is wanted with the minimum of circuit complication.

BRITISH BUILT STATION IN BULGARIA



The first of three stations to cover the country, Varna, situated on the Black Sea coast, is now on the air and will serve the eastern area. Other stations are to be at Stara Zagora and Vakarel.

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

(This list is included in the first issue of each month. Stations with an Aerial Power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions.	Metres.	kW.
Ankara (Turkey)	153	.....	1961	5
Kaunas (Lithuania)	153	.....	1961	7
Brasov (Radio Romania) (Romania)	160	.....	1875	150
Hilversum No. 1 (Holland) (10 *kW.* till 7.40 p.m. G.M.T.)	160	.....	1875	100
Lahti (Finland)	166	.....	1807	150
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	172	.....	1744	500
Paris (Radio Paris) (France)	182	.....	1648	80
Istanbul (Turkey)	185	.....	1622	5
Irkutsk (U.S.S.R.)	187.5	.....	1600	20
Deutschlandsender (Germany)	191	.....	1571	60
Droitwich	200	.....	1500	150
Minsk, RW10 (U.S.S.R.)	208	.....	1442	35
Reykjavik (Iceland)	208	.....	1442	16
Motala (Sweden)	216	.....	1389	150
Novosibirsk, RW76 (U.S.S.R.)	217.5	.....	1379	100
Warsaw, No. 1 (Poland)	224	.....	1339	120
Luxembourg	232	.....	1293	150
Leningrad, No. 1 RW53 (Kolpino) (U.S.S.R.)	232	.....	1293	100
Kharkov, RW20 (U.S.S.R.)	232	.....	1293	20
Kalundborg (Denmark)	240	.....	1250	60
Vienna, No. 2 (Austria)	240	.....	1250	0.5
Tashkent, RW11 (U.S.S.R.)	256.4	.....	1170	25
Oslo (Norway)	260	.....	1153.8	60
Moscow, No. 2, RW49 (Stchelkovo) (U.S.S.R.)	271	.....	1107	100
Tromsö (Norway)	282	.....	1063.8	10
Tiflis, RW7 (U.S.S.R.)	283	.....	1060	35
Finmark (Norway)	347	.....	864.6	10
Rostov-on-Don, RW12 (U.S.S.R.)	355	.....	845.1	20
Budapest, No. 2 (Hungary)	359.5	.....	834.5	18
Sverdlovsk, RW5 (U.S.S.R.)	375	.....	800	40
Boden (Sweden)	392	.....	765	0.6
Banska-Bystrica (Czechoslovakia)	392	.....	765	100
Geneva (Switzerland)	401	.....	748	1.3
Moscow, No. 3 (RCZ) (U.S.S.R.)	401	.....	748	100
Ostersund (Sweden)	413.5	.....	726	0.6
Voroneje, RW25 (U.S.S.R.)	413.5	.....	726	10
Oulu (Finland)	431	.....	696	1.2
Ufa, RW22 (U.S.S.R.)	436	.....	688	10
Hamar (Norway)	519	.....	578	0.7
Innsbruck (Austria)	519	.....	578	1
Tartu (Estonia)	522	.....	585	0.5
Ljubljana (Yugoslavia)	527	.....	569.3	6.3
Viipuri (Finland)	527	.....	569.3	10
Bolzano (Italy)	536	.....	559.7	10
Wilno (Poland)	536	.....	559.7	16
Budapest, No. 1 (Hungary)	546	.....	549.5	120
Beromünster (Switzerland)	556	.....	539.6	100
Athlone (Irish Free State)	565	.....	531	60
Palermo (Italy)	565	.....	531	5
Stuttgart (Germany)	574	.....	522.6	100
Alpes-Grenoble, P.T.T. (France)	583	.....	514.6	15
Riga (Latvia)	583	.....	514.6	15
Vienna No. 1 (Austria)	592	.....	506.8	100
Rabat (Morocco)	601	.....	499.2	25
Sundsvall (Sweden)	601	.....	499.2	10
Florence (Italy)	610	.....	491.8	20
Cairo, No. 1 (Egypt)	620	.....	483.9	20
Brussels, No. 1 (Belgium)	620	.....	483.9	15
Lisbon (Portugal)	629	.....	476.9	15
Tröndelag (Norway)	629	.....	476.9	20
Prague, No. 1 (Czechoslovakia)	638	.....	470.2	120
Lyons, P.T.T. (France)	648	.....	463	100
Petrozavodsk (U.S.S.R.)	648	.....	463	10
Cologne (Germany)	658	.....	455.9	100
North Regional (Slaithwaite)	668	.....	449.1	70
Sottens (Switzerland)	677	.....	443.1	100
Belgrade (Yugoslavia)	686	.....	437.3	2.5
Bodö (Norway)	686	.....	437.3	0.5
Paris, P.T.T. (France)	695	.....	431.7	120
Stockholm (Sweden)	704	.....	426.1	55
Rome, No. 1 (Italy)	713	.....	420.8	50
Kiev, RW9 (U.S.S.R.)	722	.....	415.4	35
Tallinn (Estonia)	731	.....	410.4	20
Madrid, EAJ2 (Spain)	731	.....	410.4	3
Seville (Spain)	731	.....	410.4	5.5
Munich (Germany)	740	.....	405.4	100
Marseilles, P.T.T. (France)	749	.....	400.5	90
Pori (Finland)	749	.....	400.5	1
Sortavala (Finland)	749	.....	400.5	0.25
Katowice (Poland)	758	.....	395.8	12
Scottish Regional (Falkirk)	767	.....	391.1	50
Stalino (U.S.S.R.)	776	.....	386.6	10
Toulouse P.T.T. (France)	776	.....	386.6	120
Fredrikstad (Norway)	776	.....	386.6	1
Leipzig (Germany)	785	.....	382.2	120
Barcelona, EAJ1 (Spain)	795	.....	377.4	7.5
Lwow (Poland)	795	.....	377.4	16
West Regional (Washford Cross)	804	.....	373.1	70
Milan, No. 1 (Italy)	814	.....	368.6	50
Bucharest (Romania)	823	.....	364.5	12
Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832	.....	360.6	100
Agen (France)	832	.....	360.6	0.5
Berlin (Germany)	841	.....	356.7	100
Norwegian Relay Stations	850	.....	352.9	—
Sofia (Bulgaria)	850	.....	352.9	0.75
Valencia (Spain)	850	.....	352.9	3
Simferopol, RW52 (U.S.S.R.)	859	.....	349.2	10
Strasbourg (France)	859	.....	349.2	100
Poznan (Poland)	868	.....	345.6	16
London Regional (Brookmans Park)	877	.....	342.1	50
Linz (Austria)	886	.....	338.6	15
Graz (Austria)	886	.....	338.6	7.5
Helsinki (Finland)	895	.....	335.2	10
Limoges, P.T.T. (France)	895	.....	335.2	1.5
Hamburg (Germany)	904	.....	331.9	100
Dniepropetrovsk (U.S.S.R.)	913	.....	328.6	10
Toulouse (Radio Toulouse) (France)	913	.....	328.6	60
Brno (Czechoslovakia)	922	.....	325.4	32
Brussels, No. 2 (Belgium)	932	.....	321.9	15
Algiers (Algeria)	941	.....	318.8	12
Göteborg (Sweden)	941	.....	318.8	10
Breslau (Germany)	950	.....	315.8	100
Paris (Poste Parisien) (France)	959	.....	312.8	60
Bordeaux-Sud-Ouest (France)	968	.....	309.9	2.5
Odessa (U.S.S.R.)	968	.....	309.9	10
Northern Ireland Regional (Lisburn)	977	.....	307.1	100
Genoa (Italy)	986	.....	304.3	10
Torun (Poland)	986	.....	304.3	24
Hilversum No. 2 (Holland). (15 *kW.* till 7.40 p.m. G.M.T.)	995	.....	301.5	60
Bratislava (Czechoslovakia)	1004	.....	298.8	13.5
Midland Regional (Droitwich)	1013	.....	296.2	70
Chernigov (U.S.S.R.)	1013	.....	296.2	5
Barcelona, EAJ15 (Spain)	1022	.....	293.5	3
Cracow (Poland)	1022	.....	293.5	2
Oviedo (Spain)	1022	.....	293.5	0.7
Königsberg No. 1 (Heilsberg) (Germany)	1031	.....	291	100
Parede (Portugal)	1031	.....	291	5
Leningrad, No. 2, RW70 (U.S.S.R.)	1040	.....	288.5	10
Rennes-Bretagne (France)	1040	.....	288.5	120
Scottish National (Falkirk)	1050	.....	285.7	50
Bari No. 1 (Italy)	1059	.....	283.3	20
Paris (Radio Cité) (France)	1068	.....	280.9	0.8
Tiraspol, RW57 (U.S.S.R.)	1068	.....	280.9	4
Bordeaux-Lafayette (France)	1077	.....	278.6	12
Zagreb (Yugoslavia)	1086	.....	276.2	0.7
Falun (Sweden)	1086	.....	276.2	2
Madrid, EAJ7 (Spain)	1095	.....	274	10
Vinnitsa (U.S.S.R.)	1095	.....	274	10
Madona (Latvia)	1104	.....	271.7	50
Naples (Italy)	1104	.....	271.7	1.5
Moravska-Ostrava (Czechoslovakia)	1113	.....	269.5	11.2
Fécamp (Radio Normandie) (France)	1113	.....	269.5	10
Alexandria, No. 1 (Egypt)	1122	.....	267.4	0.25
Newcastle	1122	.....	267.4	1
Nyiregyhaza (Hungary)	1122	.....	267.4	6.25
Hörby (Sweden)	1131	.....	265.3	10
Turin, No. 1 (Italy)	1140	.....	263.2	7
Trieste (Italy)	1140	.....	263.2	10
London National (Brookmans Park)	1149	.....	261.1	20
North National (Slaithwaite)	1149	.....	261.1	20
West National (Washford Cross)	1149	.....	261.1	20
Kosice (Czechoslovakia)	1158	.....	259.1	2.5
Monte Ceneri (Switzerland)	1167	.....	257.1	15
Copenhagen (Denmark)	1176	.....	255.1	10
Kharkov, No. 2, RW4 (U.S.S.R.)	1185	.....	253.2	10
Nice Corse (France)	1185	.....	253.2	60
Frankfurt (*and Relays*) (Germany)	1195	.....	251	25
Prague, No. 2 (Czechoslovakia)	1204	.....	249.2	5
Lille, P.T.T. (France)	1213	.....	247.3	60
Bologna (Radio Marconi) (Italy)	1222	.....	245.5	50
Narvik (Norway)	1222	.....	245.5	0.3
Gleiwitz (Germany)	1231	.....	243.7	5
Cork (Irish Free State)	1240	.....	241.9	1
Saarbrücken (Germany)	1249	.....	240.2	17
Riga (Latvia)	1258	.....	238.5	10
Rome, No. 3 (Italy)	1258	.....	238.5	1
San Sebastian, EAJ8 (Spain)	1258	.....	238.5	1
Nürnberg (Germany)	1267	.....	236.8	2
Juan-les-Pins (Radio Côte d'Azur) (France)	1276	.....	235.1	2.7
Christiansand (Norway)	1276	.....	235.1	0.5
Stavangar (Norway)	1276	.....	235.1	0.5
Dresden (Germany)	1285	.....	233.5	0.25
Aberdeen	1285	.....	233.5	1
Klagenfurt (Austria)	1294	.....	231.8	5
Vorarlberg (Austria)	1294	.....	231.8	5
Danzig	1303	.....	230.2	0.5
Swedish Relay Stations	1312	.....	228.7	—
Magyarovar (Hungary)	1321	.....	227.1	1.25

Station.	kc/s.	Tuning Positions.	Metres.	kW.
German Relay Stations	1330	.....	225.6	—
Montpellier, P.T.T. (France)	1339	.....	224	1.2
Lodz (Poland)	1339	.....	224	2
Dublin (Irish Free State)	1348	.....	222.6	0.5
Rjukan (Norway)	1348	.....	222.6	0.15
Salzburg (Austria)	1348	.....	222.6	0.5
Tampere (Finland)	1348	.....	222.6	0.7
Cairo No. 2 (Egypt)	1348	.....	222.6	0.5
Königsberg (Germany)	1348	.....	222.6	2
Nottoden (Norway)	1357	.....	221.1	0.15
Italian Relay Stations	1357	.....	221.1	—
L'Ile de France (France)	1366	.....	219.6	0.7
Basle (Switzerland)	1375	.....	218.2	0.5
Berne (Switzerland)	1375	.....	218.2	0.5
Warsaw, No. 2 (Poland)	1384	.....	216.8	2
Lyons (Radio Lyons) (France)	1393	.....	215.4	25
Beziers (Radio Midi) (France)	1429	.....	209.9	0.3
Alexandria, No. 2 (Egypt)	1429	.....	209.9	0.5
Turku (Finland)	1429	.....	209.9	0.5
Miskolc (Hungary)	1438	.....	208.6	1.25
Paris (Eiffel Tower) (France)	1456	.....	206	5
Pecs (Hungary)	1465	.....	204.8	1.25
Antwerp (Belgium)	1465	.....	204.8	0.1
Courtrai (Belgium)	1465	.....	204.8	0.1
Bournemouth	1474	.....	203.5	1
Plymouth	1474	.....	203.5	0.3
Binche (Belgium)	1487	.....	201.7	0.1
Chatelineau (Belgium)	1492	.....	201.1	0.1
Wallonia (Belgium)	1492	.....	201.1	0.1
Nimes (France)	1492	.....	201.1	0.7
Albacete (Spain)	1492	.....	201.1	0.2
Radio Alcoy (Spain)	1492	.....	201.1	0.1
Santiago (Spain)	1492	.....	201.1	0.5
Liege (Radio Cointe) (Belgium)	1500	.....	200	0.1
Verviers (Belgium)	1500	.....	200	0.1
Pietarsaari (Finland)	1500	.....	200	0.25
Radio Alcalá (Spain)	1500	.....	200	0.2
Karlskrona (Sweden)	1530	.....	196	0.2
Liepàja (Latvia)	1737	.....	173	0.1

SHORT-WAVE STATIONS OF THE WORLD

Station.	Call Sign.	kc/s.	Tuning Positions.	Metres.	kW.
Ponta Delgada (Azores)	CT2AJ	4,000	.....	75.00	0.05
Kharbarovsk (Russia)	RV15	4,273	.....	70.20	20
Sourabaya (Java)	YDB	4,470	.....	67.11	1
Caracas (Venezuela)	YV2RC	5,800	.....	51.72	1
San Jose (Costa Rica)	TIX	5,820	.....	51.52	1
Maracaibo (Venezuela)	YV5RMO	5,850	.....	51.28	1
Vatican City (Vatican State)	HVJ	5,969	.....	50.26	10
Trujillo (Domenica)	HIX	5,980	.....	50.16	0.2
Mexico City (Mexico)	XEBT	6,000	.....	50.00	1
Moscow (Russia)	RW59	6,000	.....	50.00	20
Drummondville (Canada)	CFCF	6,005	.....	49.96	50
Havana (Cuba)	COCO	6,010	.....	49.92	0.5
Singapore (Malaya)	ZH1	6,018	.....	49.85	0.09
Bogota (Colombia)	HJ3ABH	6,018	.....	49.85	1.6
Zeesen (Germany)	DJC	6,020	.....	49.83	5
Panama City (Panama)	HP5B	6,030	.....	49.75	0.1
Calgary (Canada)	VE9CA	6,030	.....	49.75	0.1
Boston (U.S.A.)	W1XAL	6,040	.....	49.67	10
Miami (U.S.A.)	W4XB	6,040	.....	49.67	2.5
Pernambuco (Brazil)	PRA8	6,040	.....	49.67	3
Barranquilla (Colombia)	HJ1ABG	6,042	.....	49.65	0.15
Daventry (Gt. Britain)	GSA	6,050	.....	49.59	15
Cincinnati (U.S.A.)	W8XAL	6,060	.....	49.50	10
Philadelphia (U.S.A.)	W3XAU	6,060	.....	49.50	1
Skamleback (Denmark)	OXY	6,060	.....	49.50	0.5
Manizales (Colombia)	HJ4ABL	6,067	.....	49.45	0.15
Vienna (Austria)	OER2	6,072	.....	49.41	1.5
Penang (Malaya)	ZHJ	6,080	.....	49.33	0.05
Chicago (U.S.A.)	W9XAA	6,080	.....	49.33	0.5
Nairobi (Kenya)	VQ7LO	6,083	.....	49.31	0.5
Bowmanville (Canada)	CRCX	6,090	.....	49.26	0.5
Johannesburg (South Africa)	ZTJ	6,097	.....	49.20	5
Bound Brook (U.S.A.)	W3XAL	6,100	.....	49.18	35
Chicago (U.S.A.)	W9XF	6,100	.....	49.18	10
Belgrade (Yugoslavia)		6,100	.....	49.18	1
Manizales (Colombia)	HJ4ABB	6,105	.....	49.15	1
Daventry (Gt. Britain)	GSL	6,110	.....	49.10	15
Calcutta (India)	VUC	6,110	.....	49.10	0.5
Medellin (Colombia)	HJ4ABE	6,110	.....	49.10	1
Wayne (U.S.A.)	W2XE	6,120	.....	49.02	1
Havana (Cuba)	COCD	6,130	.....	48.92	0.25
Halifax (Canada)	VE9HX	6,130	.....	48.92	0.07
Pittsburgh (U.S.A.)	W8XK	6,140	.....	48.86	40
Winnipeg (Canada)	CJRO	6,150	.....	48.78	2
Lisbon (Portugal)	CSL	6,150	.....	48.78	0.51
Caracas (Venezuela)	YV3RC	6,150	.....	48.78	1
Parede (Portugal)	CT1GO	6,198	.....	48.40	0.35
Trujillo (Domenica)	HIZ	6,316	.....	47.50	1
Caracas (Venezuela)	YV4RC	6,375	.....	47.05	1
San Jose (Costa Rica)	TIPG	6,400	.....	46.87	0.5
Barranquilla (Colombia)	HJ1ABB	6,447	.....	46.52	1
Cali (Colombia)	HJ5ABD	6,490	.....	46.21	0.1
Valencia (Colombia)	YV6RV	6,520	.....	46.00	0.5
Riobamba (Ecuador)	PRADO	6,620	.....	45.31	1
Guayaquil (Ecuador)	HC2RL	6,667	.....	45.00	0.2
British Amateurs		7,000	.....	42.86	0.01
		to		to	
		7,300		41.10	
Georgetown (British Guiana)	VP3MR	7,080	.....	42.36	0.15
Tokio (Japan)	JVP	7,510	.....	39.95	20
Prangins (Radio-Nations) (Switz'l'd)	HBP	7,797	.....	38.48	20
Quito (Ecuador)	HCJB	8,214	.....	36.50	0.25
Hong Kong (China)	ZCK3	8,750	.....	34.29	0.5
Budapest (Hungary)	HAT4	9,125	.....	32.88	5
Havana (Cuba)	COCH	9,428	.....	31.80	1
Rio de Janeiro (Brazil)	PRF5	9,501	.....	31.58	5
Daventry (Gt. Britain)	GSB	9,510	.....	31.55	15
Melbourne (Australia)	VK3ME	9,510	.....	31.55	1.5
Jelöy (Norway)	LKJI	9,530	.....	31.48	1
Schenectady (U.S.A.)	W2XAF	9,530	.....	31.48	25
Zeesen (Germany)	DJN	9,540	.....	31.45	5
Zeesen (Germany)	DJA	9,560	.....	31.38	5
Bombay (India)	VUB	9,565	.....	31.36	4.5
Millis (U.S.A.)	W1XK	9,570	.....	31.35	10
Daventry (Gt. Britain)	GSC	9,580	.....	31.32	15
Lyndhurst (Australia)	VK3LR	9,580	.....	31.32	1
Buenos Aires (Argentina)	LRX	9,580	.....	31.32	5
Philadelphia (U.S.A.)	W3XAU	9,590	.....	31.28	1
Sydney (Australia)	VK2ME	9,590	.....	31.28	20
Eindhoven (Holland)	PCJ	9,590	.....	31.28	20
Prangins (Radio-Nations) (Switz'l'd)	HBL	9,595	.....	31.27	20
Rome (Italy)	2RO	9,635	.....	31.13	25
Lisbon (Portugal)	CT1AA	9,655	.....	31.07	2.5
Lisbon (Portugal)	CT1CT	9,677	.....	31.00	0.5
Madrid (Spain)	EAQ	9,860	.....	30.43	20
Bandoeng (Java)	PMN	10,260	.....	29.24	10
Ruysselede (Belgium)	ORK	10,330	.....	29.04	9
Tokio (Japan)	JVN	10,710	.....	28.01	20
Tokio (Japan)	JVM	10,740	.....	27.93	20
Medellin (Colombia)	HJ4ABA	11,710	.....	25.62	1
Winnipeg (Canada)	CJRX	11,720	.....	25.60	2
Paris (Radio-Colonial) (France)	TPA4	11,720	.....	25.60	10
Daventry (Gt. Britain)	GSD	11,750	.....	25.53	15
Zeesen (Germany)	DJD	11,770	.....	25.49	5
Boston (U.S.A.)	W1XAL	11,790	.....	25.45	10
Rome (Italy)	2RO	11,810	.....	25.40	25
Daventry (Gt. Britain)	GSN	11,820	.....	25.38	15
Wayne (U.S.A.)	W2XE	11,830	.....	25.36	1
Lisbon (Portugal)	CT1AA	11,830	.....	25.36	2
Daventry (Gt. Britain)	GSE	11,860	.....	25.29	15
Pittsburgh (U.S.A.)	W8XK	11,870	.....	25.27	40
Paris (Radio-Colonial) (France)	TPA3	11,880	.....	25.23	10
Addis Ababa (Abyssinia)	ETB	11,955	.....	25.09	3.5
Moscow (Russia)	RW59	12,000	.....	25.00	20
Lisbon (Portugal)	CT1CT	12,082	.....	24.83	0.5
Reykjavik (Iceland)	TFJ	12,235	.....	24.52	7.5
Parede (Portugal)	CT1GO	12,396	.....	24.20	0.35
Suva (Fiji)	VPD	13,075	.....	22.94	1
Warsaw (Poland)	SPW	13,635	.....	22.00	10
British Amateurs		14,005	.....	21.42	0.01
		to		to	
		14,395		20.84	
Vatican City (Vatican State)	HVJ	15,123	.....	19.84	10
Daventry (Gt. Britain)	GSF	15,140	.....	19.82	10
Daventry (Gt. Britain)	GSO	15,180	.....	19.76	15
Zeesen (Germany)	DJB	15,200	.....	19.74	5
Pittsburgh (U.S.A.)	W8XK	15,210	.....	19.72	40
Eindhoven (Holland)	PCJ	15,220	.....	19.71	20
Paris (Radio-Colonial) (France)	TPA2	15,243	.....	19.68	10
Daventry (Gt. Britain)	GSI	15,260	.....	19.66	10
Wayne (U.S.A.)	W2XE	15,270	.....	19.65	1
Zeesen (Germany)	DJQ	15,280	.....	19.63	5
Buenos Aires (Argentina)	LRU	15,290	.....	19.62	5
Daventry (Gt. Britain)	GSP	15,310	.....	19.60	15
Schenectady (U.S.A.)	W2XAD	15,330	.....	19.56	20
Budapest (Hungary)	HAS3	15,370	.....	19.52	6
Zeesen (Germany)	DJE	17,760	.....	16.89	5
Wayne (U.S.A.)	W2XE	17,760	.....	16.89	1
Huizen (Holland)	PHI	17,770	.....	16.88	23
Bound Brook (U.S.A.)	W3XAL	17,780	.....	16.87	35
Daventry (Gt. Britain)	GSG	17,790	.....	16.86	10
Bandoeng (Java)	PLE	18,830	.....	15.93	60
Daventry (Gt. Britain)	GSH	21,470	.....	13.97	10
Wayne (U.S.A.)	W2XE	21,520	.....	13.94	1
Daventry (Gt. Britain)	GSJ	21,530	.....	13.93	10
Pittsburgh (U.S.A.)	W8XK	21,540	.....	13.93	40

Random Radiations

By "DIALLIST"

Nearing Radiolympia

IT is only just over a fortnight now until the Exhibition opens, so fast does time fly. Everybody's wondering what its big features are going to be, but up to the time of writing not much information has been available. Of one thing, though, we can be certain: this is going to be a year of "all-wave" receiving sets. Nearly every manufacturer is making them, and many believe that they will achieve record sales. I am not quite so sure myself, for the man in the street in this country has never so far worked up a vast amount of enthusiasm about short-wave reception. One reason, I believe, is that so few sets with a high degree of sensitivity on the short-wave range have come his way. Tuning has also been rather difficult, and this year manufacturers are doing their utmost to make it easier, attacking the problem in several different and interesting ways. I should feel a good deal more confident about the future of the "all-wave" set if the man in the street had not been given the idea that he has only to buy one to be able to bring in the whole world from China to Peru whenever he feels inclined to switch over to the short-wave range and turn the tuning knob.

Still No Television

AS I write the opening date of even experimental transmissions from the London high-definition television station is uncertain, and the B.B.C. will make no promises. The latest information is that the aerial, which has taken such a long time to put up, is now complete, and one does not see why further delays should take place. After all, the two companies concerned were both in possession of complete transmitting plants a long while ago, and each was conducting transmissions—the Baird Company from the Crystal Palace and E.M.I. from Hayes. Surely they should be able to give us something from the Alexandra Palace without much further beating about the bush.

Television at Olympia

It will be rather tragic if we don't have television demonstrations at the Radio Show. It was strongly featured a year ago at the Berlin Exhibition, and the German papers were then inclined to gloat over the fact that though we had been talking about television for years we still had done nothing. And yet it is over two and a half years since it was demonstrated in this country that clear, steady images of real entertainment value could be transmitted and received over reasonable distances. Why, in the name of Fortune, can't we get on with things?

More Radio Insurance

MORE and more firms seem to be adopting schemes for enabling customers to insure the maintenance of their sets by payment of a yearly sum. One London company, whose insurance plan has just got under way, writes to me: "It is of course the way that radio or any other complicated apparatus should be sold." I agree wholeheartedly with this sentiment, and I trust that now the idea of service insurance has taken root it may not be long before firms conducting such schemes are found here, there and everywhere.

Ultra-shorts and the Telephone Service

FOR some time the Post Office telephone link across the Bristol Channel has been most successfully maintained by very short-wave wireless transmissions. In a recent announcement Major Tryon states that a great deal more use is to be made of ultra-short-wave links. There are numbers of places in this country where their use can be extended with great advantage and at far less cost than submarine cables. "Wavelet" wireless is likely to be used to supplement the existing cables between England and France, England and Ireland, and England and the Channel Islands. Not the least of the advantages of the radio link is the low cost of installing the necessary stations and keeping them going.

They Do These Things Better To-day

THE other day when I was at a friend's house the rather ancient set with which nothing would persuade her to part gave a sudden loud plop and then went all muzzy. It was pretty obvious that the reed of the loud speaker (yes, it is as old as that) required adjustment, and a brief inspection showed that the only way to deal with this was to take the set out of its cabinet. To do this I had to remove, just for a start, fourteen wood screws, two large and the rest of medium size. Then came four nuts for which a box spanner was required. Six tiny metal screws followed. Then a kind of tray holding the batteries had to be taken out, and after that the chassis came free. There was an adjusting screw for the loud speaker unit right enough, but it was not too easy to get at. The whole job, which should have taken about three minutes, needed well over an hour for its completion. Fortunately for the service man, most makers to-day put their sets together in such a way that they can be taken from their cabinets without one's needing to use a box spanner and screwdrivers of three different sizes. Not all of them, though, are as simple to remove as they might be—and the modern radiogram can be a perfect beast to deal with if you have to get at its inside.

Welcome Programme Changes

THE new arrangement of programmes which will come into operation in the autumn will be welcomed by most listeners. One of the most striking changes concerns the news bulletins. Hitherto both Regionals and Nationals have given the first of these at six o'clock, and for the life of me I never could see why both sets of wavelengths should be occupied simultaneously in the transmission of a single bulletin. Six o'clock, too, was a very awkward hour for many people, and these will find the new scheme with the first news bulletin from the Nationals at six o'clock and from the Regionals at seven greatly to their advantage. Time was when the second news bulletin at nine o'clock was also broadcast on both wavelengths. This gave way to a full bulletin from the Nationals only at 9.30 and a brief sports summary from the Regionals at 10.10. We are now to have full bulletins from the Nationals at nine and the Regionals at ten. There will also be the ten minutes' summary at 11.30, which is so useful to those who have been out for the evening.

Brightening Them Up

There is no doubt that those responsible for the building of the B.B.C.'s programmes are making a real effort to give the listener lighter and brighter programmes on one set of wavelengths. The spacing out of the news bulletins will help a good deal towards this by unblocking the periods available for both late afternoon and evening programmes. "The Foundations of Music" is (or should one say are?) to disappear as a feature of the "solid chunks" type, though items showing the development of music will be interspersed in the ordinary programmes. This brings back somehow youthful memories of Gregory powder concealed in jam! Let's hope that there will be plenty of jam. I am glad to see that the daytime programmes are to be improved all round, that there will be full alternatives on Saturday afternoons, and that eventually we shall be equally well served on Sunday afternoons.

Ultra Short Waves for Rescue Work in Mines

AN interesting series of experiments was recently conducted in the Bettes-hanger Colliery of Messrs. Pearson and Dorman Long, Ltd., with the object of ascertaining whether ultra-short-wave communication could be of assistance to rescue parties in the event of mining accidents. One transreceiver, operating on 4½ metres, was installed at the pit-head, another in the generating station at the bottom of the shaft at a depth of 2,160ft., and a third in a remote part of the workings, some 2,000ft. from the pit bottom. In spite of the fact that the normal work of the mine, including the running of 3,000-volt plant in the generating room, was carried on during the whole period of the tests, perfect two-way communication was maintained between the three stations, the signals being rated at R9 plus.

The apparatus employed comprised three standard equipments made by Trans-receivers, Ltd., of Ewell, and identical with those described in a recent issue of *The Wireless World*, the power radiated from the aerial (a collapsible di-pole array) being approximately 0.5 watt.

As to the practical value of the experiments, it would appear to be established that satisfactory communication between rescue parties and the pit bottom and surface can be relied upon, and in the case of disaster this would greatly facilitate the transmission of reports or instructions such as requests for special tools, apparatus or supplies. It might also be practicable to instal ultra-short wave equipments permanently at strategic points in the mines. These questions are, however, for the mining engineer to decide. It is sufficient for the moment to record that the radio engineer has produced a new means for emergency communication which can undoubtedly be adapted to the practical needs of the miner.

The Wireless World

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Broadcast Station Power

B.B.C. Aims

THE question of the power of British broadcasting stations has been much in the limelight during the past week or so and many British residents abroad have written to the newspapers deploring the fact that B.B.C. programmes are not well heard in Europe by comparison with the transmitters of other nations.

If such a state of affairs really exists, it is of comparatively recent date, because it has been well known that not so long ago British stations were widely listened to on the Continent as the best alternatives to local transmitters.

But, if we accept the accusations that our stations are of poor strength abroad, we are really handing a bouquet to the engineers of the B.B.C., rather than casting a slur on their competence. Quite obviously the B.B.C.'s first duty is to provide programmes at the best possible strength to listeners in what is regarded as the service area of the transmitters. An obsolete and inefficient aerial array will produce the result that a large proportion of the radiated energy is dissipated beyond the service area, but more recent research into aerial design has produced improvements, adopted by the B.B.C., which enable the radiation of the transmitter to be concentrated in the service area and restricting the amount of energy which will travel further afield.

If the B.B.C. is expected to design stations which will provide good reception performance in Southern and Eastern Europe, then we believe Sir Noel Ashbridge would confirm our belief that present aerial designs would have to be scrapped and different arrays set up, the effect of which would inevitably be that complaints of poor reception from listeners in the service areas of the stations would pour into the B.B.C. postbag.

An Olympic Blunder

Need for Apology

THE B.B.C. will find it difficult to devise any excuse for the commentator to whom they entrusted the task of broadcasting an account of the opening of the Olympic Games in Berlin. Fortunately wide publicity has been given to this matter through the Press, and we reproduce elsewhere in this issue two letters which have appeared in *The Daily Telegraph* on the subject.

It is to be hoped that these expressions of amazement and condemnation of the B.B.C. narrator's conduct will make it clear that public opinion in this country deplores this blunder. An apology from the B.B.C. seems clearly indicated.

The Radio Show

Three Special Numbers

OLYMPIA'S Annual Radio Show opens this year on August 26th.

Again *The Wireless World* will devote three special numbers to giving readers a full account of everything of interest at the Exhibition.

Next week's issue will be a Show Forecast, indicating, from what advance information is available, the principal features of the Show and containing a general guide to what to look out for.

The issue of August 28th will include a Stand-to-Stand Report, and will be a fully illustrated record of the Show.

In the third special number, to be dated September 4th, the technical staff of *The Wireless World* will review the general trend of the Exhibition and discuss new developments in detail.

Screening Cathode-

MAGNETIC SHIELDS OF HIGH-PERMEABILITY

IN television receivers, and especially in those of compact design, there is a serious risk of unwanted deflection of the cathode-ray beam by stray magnetic fields. The author of this article discusses the advantages of screens of high-permeability alloy for providing protection against these fields.

THE beam of electrons in a cathode-ray tube is easily deflected by a magnetic field, and, as is well known, use is made of this property in television and oscillograph work. Unfortunately there are always a number of stray magnetic fields associated with a television receiver due to leakage flux from mains transformers and chokes, particularly in a compact assembly. Furthermore, unidirectional magnetic fields, and those due to transients and audio frequencies can exist, and all tend to affect the electron beam. In one instance the spot on the screen of a cathode-ray tube installed in a well-known observatory had a permanent deflection of 2 cms. which was eventually traced to the magnetic field set up by the cast-iron water radiators, which had become permanently magnetised.

Now it is not always possible to eliminate these stray fields at their source, and therefore some means must be adopted to prevent them reaching the electron stream in the cathode-ray tube. The elementary principles of magnetic shielding can be easily demonstrated by any interested reader by means of a pocket compass, a bar magnet and a cylinder of magnetic material. Although it is not advisable to bring such a magnet near a high-grade compass which might thus become demagnetised or reduced in sensitivity, the experiment consists of holding the bar magnet so that the South pole, say, is nearer the compass needle (Fig. 1). It will be observed that whatever the position of the magnet the compass needle always adjusts itself to point at this South pole. This means the compass needle is strongly affected by the flux from the permanent magnet and tends to align itself with the direction of this flux. If now the compass be surrounded by a cylinder of magnetic material (e.g. iron), as shown in the sketch, it will be found that the needle is affected to a much less extent. This is the case because the bulk of the flux from NS prefers to take a path through the magnetic material, leaving only a small amount in the region of the compass. A piece of iron drainpipe could be used for this demonstration, and in the early days of cathode-ray tubes it is interesting to note that some experimenters actually mounted their tubes inside thick iron drainpipes.

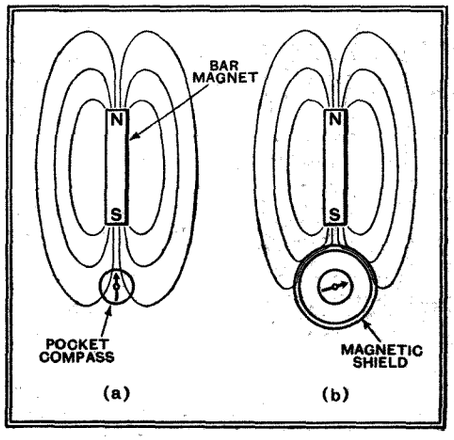


Fig. 1.—A pocket compass is normally strongly affected by magnetic flux from a bar magnet, but the interposition of a magnetic shield greatly reduces the deflection of the needle.

The amount of flux within the screen depends upon the permeability of the material employed and its thickness, or in other words upon its magnetic reluctance. A material having high permeability is particularly suitable for screening because the thickness can be reduced and a shield of reasonable weight employed. For production television receivers the idea of placing a drainpipe weighing some 56 lb. around the glass bulb of an expensive cathode-ray tube is unlikely to be favourably received.

Fortunately there are now available materials having permeabilities many times that of cast iron or even soft iron, an excellent example being Mumetal. This is a nickel-iron alloy containing nearly 80 per cent. of nickel and having permeability and flux density curves indicated in Fig. 2. These results were obtained on an actual specimen tested by the writer. It will be noticed that with this sample the maximum permeability of 76,000 occurs at H=0.043 gilberts per cm. and that saturation is approached for approximately H = 0.5 gilberts per cm.

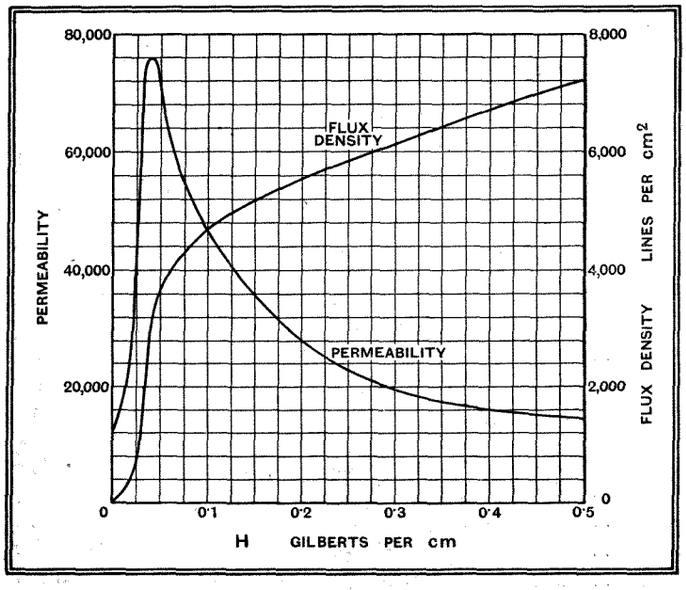


Fig. 2.—Direct-current permeability and flux density characteristics of Mumetal.

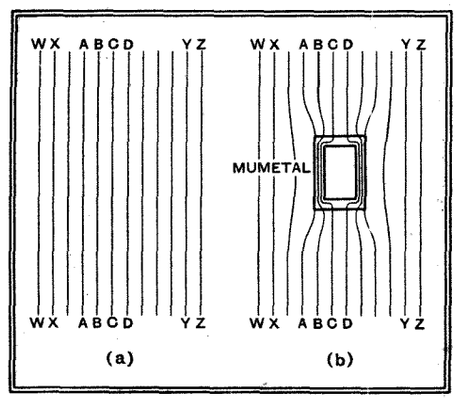


Fig. 3.—Normal disposition of the earth's magnetic field (a), and (b), the effect of interposing Mumetal.

It is known that the strength of the earth's magnetic field is approximately 0.47 gilberts per cm., and for this reason it is often erroneously thought that Mumetal is always saturated by the earth's field. A little consideration will soon make it clear that this is not the case, for another way of expressing the magnitude of the earth's field is to state that the flux density B is the same as H (permeability is unity for air), whence it can be seen that there is a density of about 1 line per 2 square cms. Where any object such as a screen is immersed in the earth's field only a few

Ray Tubes

ALLOYS

By

G. A. V. SOWTER, B.Sc., A.M.I.E.E.

magnetic lines pass through the screen by reason of the low reluctance offered. Thus in Fig. 3 the flux lines marked AA, BB, CC, etc., take the paths of lowest reluctance through the Mumetal, whilst the lines WW, XX, YY, etc., are unaffected since the path via the Mumetal is longer and of greater reluctance than the original paths. Since the flux density in the Mumetal is thus quite small the effective magnetising force due to the earth's field is also small, values of the order of 0.001 gilberts per cm. being not unusual and depending upon the dimensions of the sample under consideration. Another explanation of the same phenomenon is to state that poles are set up on the Mumetal and oppose the earth's field, the resultant magnetising force being the difference between the earth's magnetising force and that due to these poles.

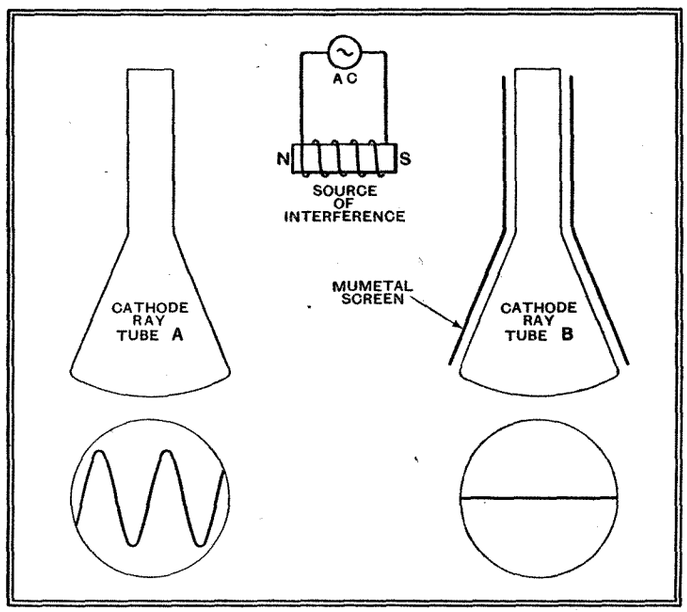


Fig. 4.—Arrangement of apparatus used to demonstrate the shielding effect of Mumetal.

Having thus indicated that Mumetal is a suitable material for screens, it is interesting to describe a recent practical demonstration showing the shielding effect of Mumetal screens. Two exactly similar sets of cathode-ray oscillograph equipment and time base unit, kindly lent by Messrs. A. C. Cossor, Ltd., were arranged as indicated in Fig. 4, and a short iron-cored solenoid carrying 50-cycle AC was placed symmetrically with respect to both tubes in position NS. Cathode-ray tube B was surrounded by a Mumetal shield of the type indicated in Fig. 9(b), and the time bases were adjusted so that a stationary 50-cycle waveform could be obtained on the oscillograph screens. The unshielded tube showed a waveform of amplitude sufficient to fill the screen, whilst there was little or no evidence of the presence of 50-cycle interference on the screen of tube B. Figs. 5, 6, and 7 are actual photographs taken by Messrs. A. C. Cossor, Ltd., of a similar demonstration arranged by them in their laboratories, and the writer gratefully acknowledges his indebtedness for permission to use these photographs for illustrating the present article.

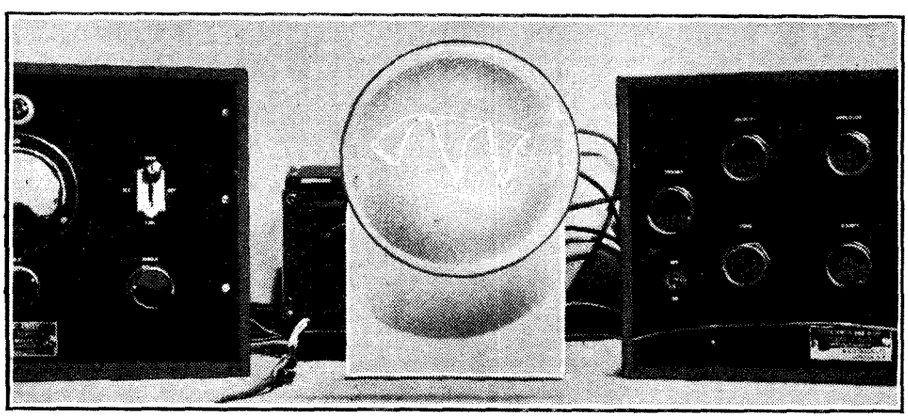


Fig. 5.—A demonstration of shielding a cathode-ray tube. The complete test assembly, with a transformer producing stray flux and an unshielded tube. Note the heavy 50-cycle ripple.

The photograph, Fig. 8, shows some typical examples of Mumetal screens, whilst Fig. 9 gives an indication of the manner in which different screens are employed. Type (a) is exceptionally elaborate, constructed in Mumetal $\frac{1}{16}$in. thick and used by the Radio Research Board for their DF compass by Mr. Bainbridge-Bell, one of the pioneer users of Mumetal screens for shielding cathode-ray tubes. Type (b), the most common and very effective, is in Mumetal $\frac{1}{32}$in. thick, whilst type (c) is of simpler construction but not necessarily cheaper, because the shape involves waste material. Type (d)—a simple cylinder—has not such good properties as (b), owing to its dimension-ratio, or in effect because it does not fit snugly on the tube. Cathode-ray tubes with terminals on the end caps necessitate the use of cylinders which easily pass over these terminals and thus involve somewhat larger and more expensive screens than can be employed with tubes having end or side contacts similar to those of radio valves. Type (e) is a welded cylinder covering only part of the oscillograph tube and is effective in removing weak interference. Type (f) consists of a wide strip of Mumetal, say, 0.015 or 0.010in. thick wound up to form a cylinder composed of 5 to 10 turns; this is likely to become a standard fitting on television receivers.

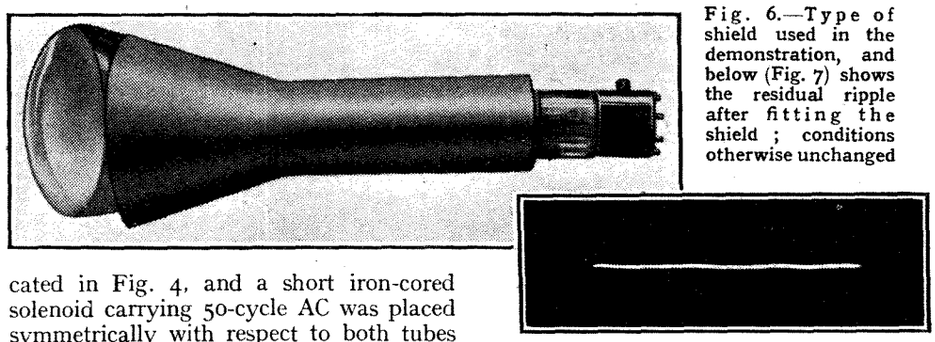


Fig. 6.—Type of shield used in the demonstration, and below (Fig. 7) shows the residual ripple after fitting the shield; conditions otherwise unchanged

Avoiding Air Gaps

In some cases it is possible to use another nickel-iron alloy termed "2129 Alloy" for screens where interference is not strong, but, thickness for thickness, the Mumetal is about five times as effective as "2129 Alloy" and thirty times as effective as iron. Experience has shown that best results are obtained when joints are welded, although lapped joints similar to those on air-tight tins are efficient for thin Mumetal. Riveted joints are to be avoided, since they constitute a source of magnetic weakness, flux getting through the effective air gaps. On test riveted screens show up badly and are seldom used nowadays. Screens are generally held in position by means of webs welded externally,

Screening Cathode-ray Tubes—

as indicated in Fig. 8, or by pieces of felt, rubber, or sorbo rubber placed inside the screen and resting on the glass bulb.

Although seldom necessary for ordinary television receivers or oscillograph equipment, it has been found essential in some instances to construct composite screens made up from various materials. One example is a 100-kilovolt tube used for the study of waveforms of transients on switchgear and high-tension apparatus which of necessity had to be located in a position subject to extraordinary interference. Here the magnetic screen consisted of an inner lining of Mumetal covered by a copper screen, then a "2129 Alloy" screen, then another copper screen, and finally a soft iron screen. Suitable air spaces or gaps were placed between the component screens, and the final assembly reduced the interference to one ten-thousandth of its original value.

Multi-layer Screens

In some cases there are advantages to be gained by the use of gaps on screens consisting of more than one layer, and the Cambridge Instrument Co. manufacture a magnetic screen (for its Paschen galvanometer) which is essentially a spiral of Mumetal strip wound up so that there is an optimum air gap between turns. National Physical Laboratory tests on a screen of this type showed a reduction of stray field of the order of 1,000/1. For convenience television magnetic screens are usually tested by the manufacturer by comparing the deflections on a ballistic galvanometer when a search coil is placed in a stray field, first unshielded, and then inserted in the screen under test. The cathode-ray tube, e.g., types (e) and (f), the effective screening ratio will of necessity be less than the values quoted.

Type of Mumetal Screen.	Thickness of Metal.	Screening Ratio measured by D.C. reversals and ballistic galvanometer.
(a) of Fig. 9 ..	.064 inch	600
(b) „ ..	.064 „	400
	.032 „	150
(c) „ ..	.064 „	230
	.032 „	80
(d) „ ..	.032 „	40
(e) „ ..	.032 „	30
(f) „ ..	10 turns of .015 inch	400

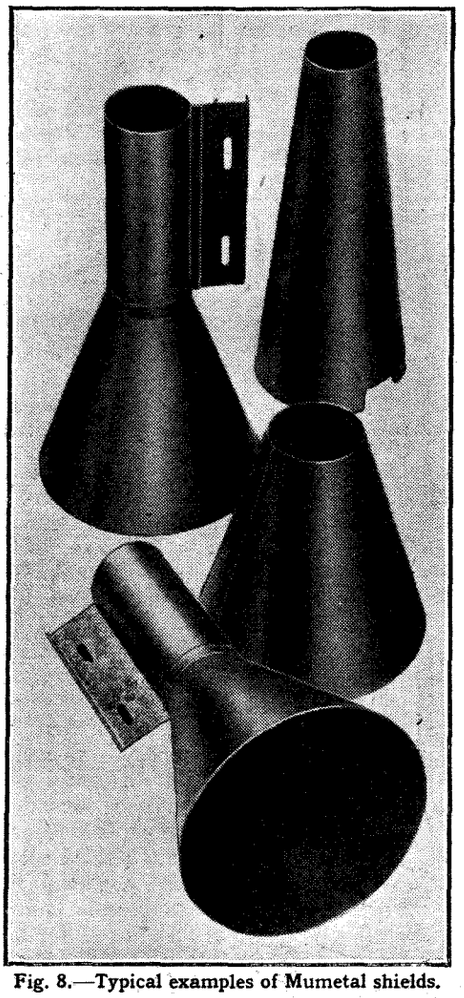


Fig. 8.—Typical examples of Mumetal shields.

stray field is generally produced by a solenoid through which direct current is reversed when a deflection is required, and it is worthy of note that the reduction ratios shown in the accompanying table have been measured on the types of screen quoted by means of this test.

These are average figures of the reduction of stray field when the search coil is placed inside the screen under test conditions. It should be pointed out that with screens covering only part of the

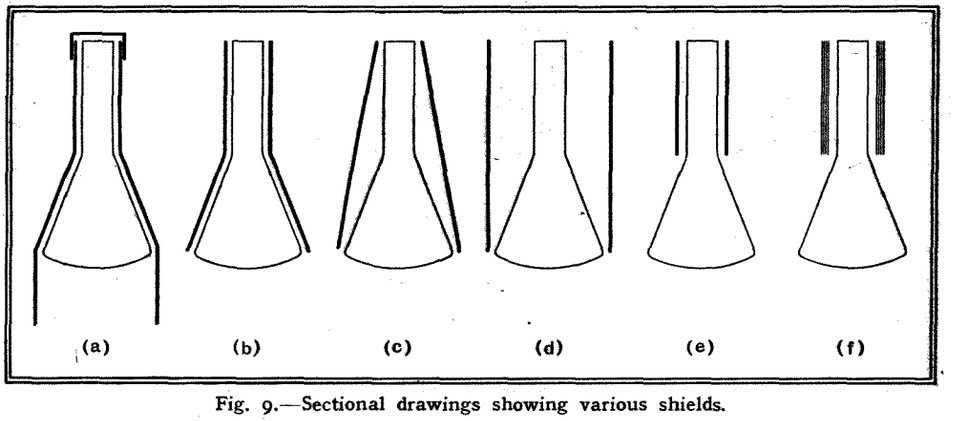


Fig. 9.—Sectional drawings showing various shields.

Another method of test which is fairly obvious is by use of AC, with a search coil and a calibrated amplifier fitted with attenuator, but satisfactory results have been obtained in the aforementioned manner, the main object of the test being to confirm that the screen has been suitably heat-treated in order to develop its magnetic properties. In practice a screening ratio of 30/1 is adequate for television receivers where mains transformers and chokes are not nearer than 2ft. from the tube, whilst a value of 100/1 seems to meet most practical requirements.

It would thus appear that the utilisation of Mumetal for magnetic shields in television receivers and cathode-ray oscillographs is a distinct advance and will do much to contribute to clarity of reproduction, particularly with compact receivers. Careful screen design is, however, essential because Mumetal is an expensive material; it contains nearly 80 per cent. nickel, is produced in high-frequency furnaces, and requires close metallurgical control in the production of the sheet form. Prior to its final heat treatment wherein the magnetic properties are developed, it can be bent, welded, drilled, and treated generally like mild steel, but, after annealing, it should not be deformed if the magnetic properties are to be maintained. It is extremely stable in its properties, and is actually used by the National Physical Laboratory for standard current transformers. As a result, no hesitation need be felt in applying the properties of this remarkable alloy for the elimination of magnetic interference.

The author is indebted to the Telegraph Construction & Maintenance Co. for permission to publish certain data in this article.

THE RADIO INDUSTRY

A MOBILE broadcasting van, mounted on an 8-cwt. Commer chassis, is being produced as a completely equipped unit by Easco Broadcast Services, of 1, 3, and 18, Brixton Road, London, S.W.9. The equipment comprises a wide-angle speaker unit on the roof, an 80-watt amplifier, twin turntables, microphone, and an E.D.C.C. rotary converter, etc., etc., together with an extension speaker. Although the van is permanently wired, all equipment can be removed in ten minutes, so that it can be used for ordinary work.

A new "Super-Model" microphone-gramophone control unit is described in a leaflet issued by M.R. Supplies, 11, New Oxford Street, London, W.1. Switches are fitted to enable either or both inputs to be completely switched off.

A leaflet is issued by the A.E.F. Manufacturing Co., 17, Queensway, Ponders End, Middx., describing midget accumulators for miniature sets, deaf aids, etc. Capacities and weights range respectively from 2 AH and 8 ozs. upwards.

A new "straight" three-valve battery receiver (Model 294) has just been introduced by Marconiphone. The coupling between the detector and output stage is designed to provide automatic compensation for the deterioration in quality normally produced by the application of reaction.

New Goltone products for the present season includes a radio suppressor unit for connection to domestic electrical appliances, 2-pin fused plugs suitable for the protection of radio sets, and a series of rubber cowls for bulldog connectors.

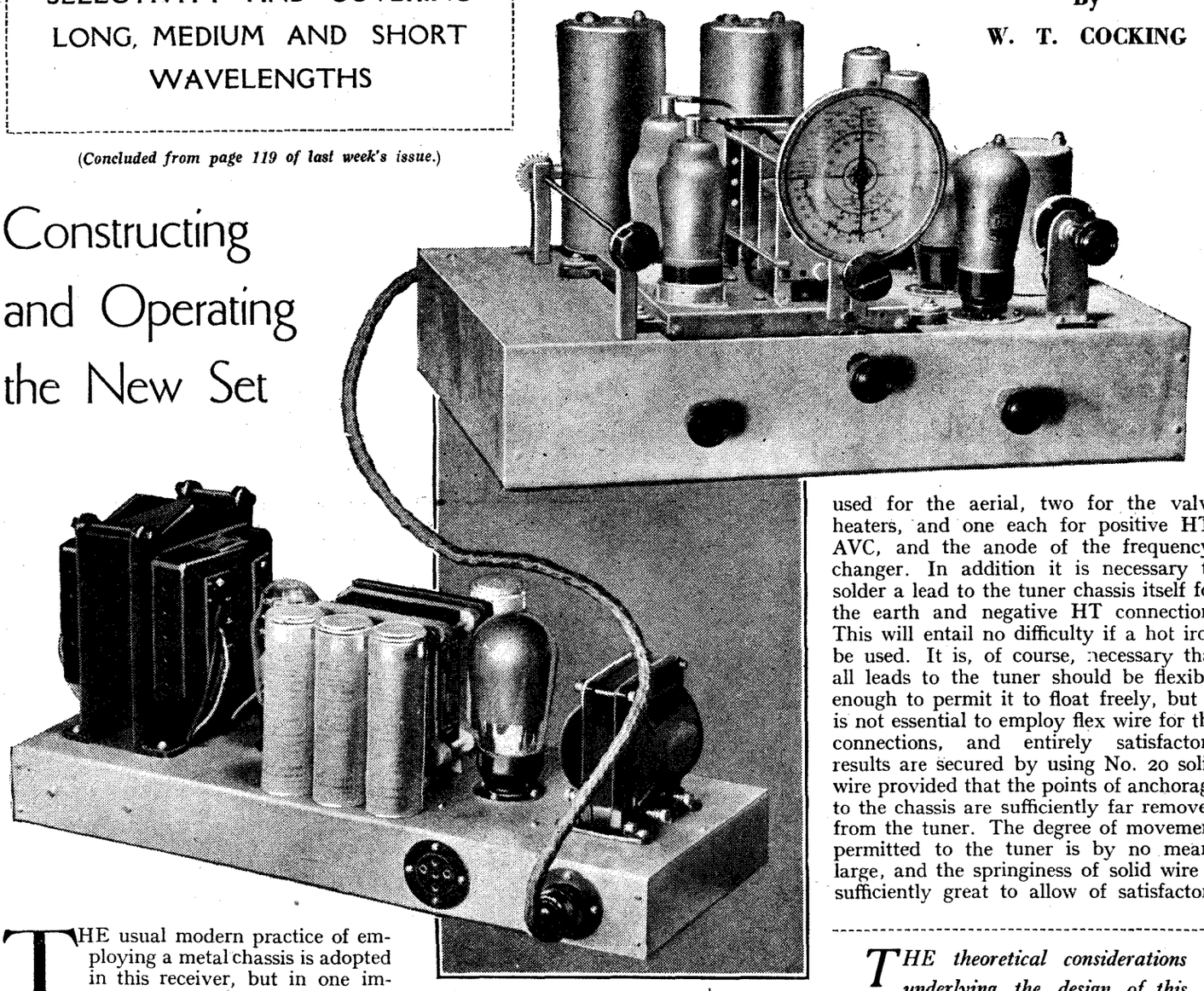
The *Wireless World* All-Wave Super Seven

A SENSITIVE RECEIVER WITH VARIABLE SELECTIVITY AND COVERING LONG, MEDIUM AND SHORT WAVELENGTHS

By W. T. COCKING

(Concluded from page 119 of last week's issue.)

Constructing and Operating the New Set



THE theoretical considerations underlying the design of this receiver and the details of the circuit employed have already been described in "The Wireless World," and in this article the construction of the set is dealt with. The operation is also treated in detail and the preliminary adjustments are explained.

THE usual modern practice of employing a metal chassis is adopted in this receiver, but in one important respect a somewhat different course has been taken. This is in the arrangement of the tuner which contains the gang condenser, tuning coils, and the HF and frequency-changer valves. It will be remembered that this section of the receiver is available as a complete unit having a steel chassis of its own. The chassis proper of the receiver is also of steel and the tuner is mounted on it by means of four bolts, absorbent rubber bushes being interposed between the two chassis. This serves a dual purpose; it allows the tuner chassis to be insulated from the main chassis so that it can be earthed at one point only and, more important, it affords a mechanical insulation to shock. This is almost essential if serious microphony or actual howling is to be avoided in short-wave reception; sometimes, too, it is necessary on the ordinary broadcast wavelengths, particularly when loud speaker and receiver are mounted in the same cabinet.

The tuner, which is supplied with the necessary rubber bushes, has seven soldering tags for the connections, two being used for the aerial, two for the valve heaters, and one each for positive HT, AVC, and the anode of the frequency-changer. In addition it is necessary to solder a lead to the tuner chassis itself for the earth and negative HT connection. This will entail no difficulty if a hot iron be used. It is, of course, necessary that all leads to the tuner should be flexible enough to permit it to float freely, but it is not essential to employ flex wire for the connections, and entirely satisfactory results are secured by using No. 20 solid wire provided that the points of anchorage to the chassis are sufficiently far removed from the tuner. The degree of movement permitted to the tuner is by no means large, and the springiness of solid wire is sufficiently great to allow of satisfactory results being secured, and it is naturally more convenient than flex.

Throughout the receiver full use has been made of mounting boards for carrying small components such as resistances

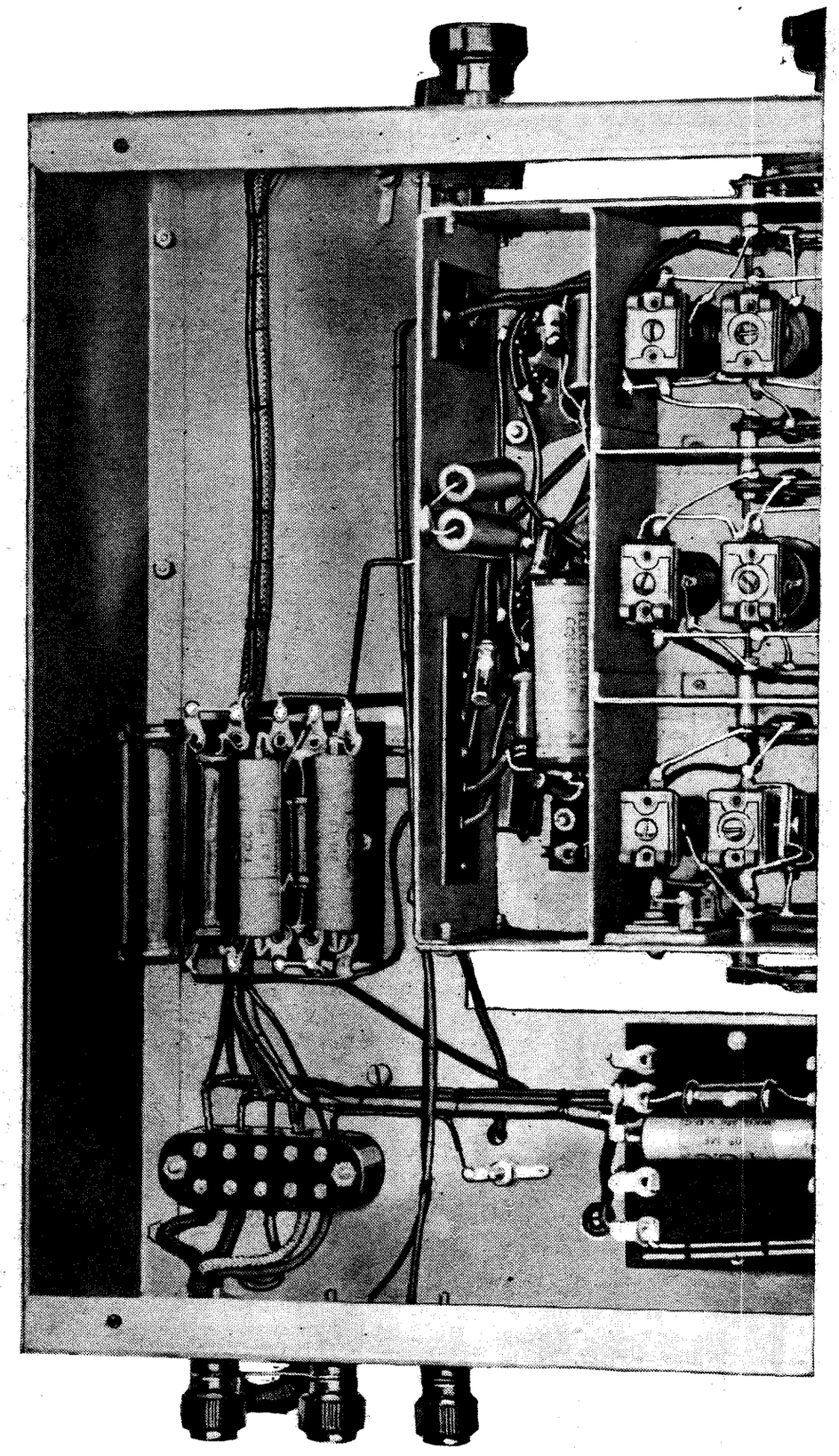
and condensers. This greatly facilitates the wiring, for all internal connections on the boards can be made before they are mounted in the receiver. The condenser C1 is carried by one of these boards, and as will be seen from the drawings, it actually consists of two lengths of No. 16 tinned copper wire, one secured to each of two opposing tags on the board. The wires are cut so that they overlap by 1⅜in. and are then sleeved to avoid a short-circuit and bound together with thread.

Separate heater leads are provided for each valve in order to permit a fairly small gauge of wire, No. 20, being used without any serious drop in voltage. In this case, it makes for easier wiring to do this rather than to run a single pair of heavy wires, for there are numerous bends. The connections to the tuner, of course, carry the current for a pair of valves, but the drop here is negligible owing to the short length of these particular leads. The heater wiring together with all other leads of low HF potential, such as the HT and screen feed leads and some of the pick-up connections, are all bunched together and bound with thread. This is not an essential, but it does make for a robust and rigid assembly, and in view of its mechanical strength, it is well worth the small extra trouble involved.

Adjusting the Receiver

The tuner is provided with two aerial terminals and neither end of the aerial coupling coil is earthed. This is in order to permit a dipole aerial to be used for short-wave reception, and it also allows of the use of an ordinary horizontal aerial with a twisted-pair downlead in cases of local interference. The two connections are consequently brought out to terminals on the receiver, but in most cases the best results will be secured with the earth terminal strapped to the aerial terminal nearest to it and the aerial taken to the remaining terminal. Although a dipole aerial may give increased efficiency at wavelengths close to the one at which it resonates, it is the writer's experience that the ordinary inverted-L aerial is better for general reception over a wide band of wavelengths. There is no question that it is better on the medium and long wavebands.

The only adjustments necessary when setting up the receiver are in the IF amplifier, and they are most readily made with the aid of a modulated test oscillator. This should be set to 456 kc/s and its low-potential output lead connected to the chassis, the high potential lead being taken *via* a 0.0002 mfd. condenser or an artificial aerial for insulation purposes to a crocodile clip termination so that connection can readily be made to any part of the receiver. It is quite possible to determine the correct gauging adjustments by ear, but it is much better to use some form of visual indicator. This may take the form of a milliammeter joined in the anode circuit of the first IF valve—in series with R6, and on the HT side of it; alternatively, a voltmeter may be connected across R4.

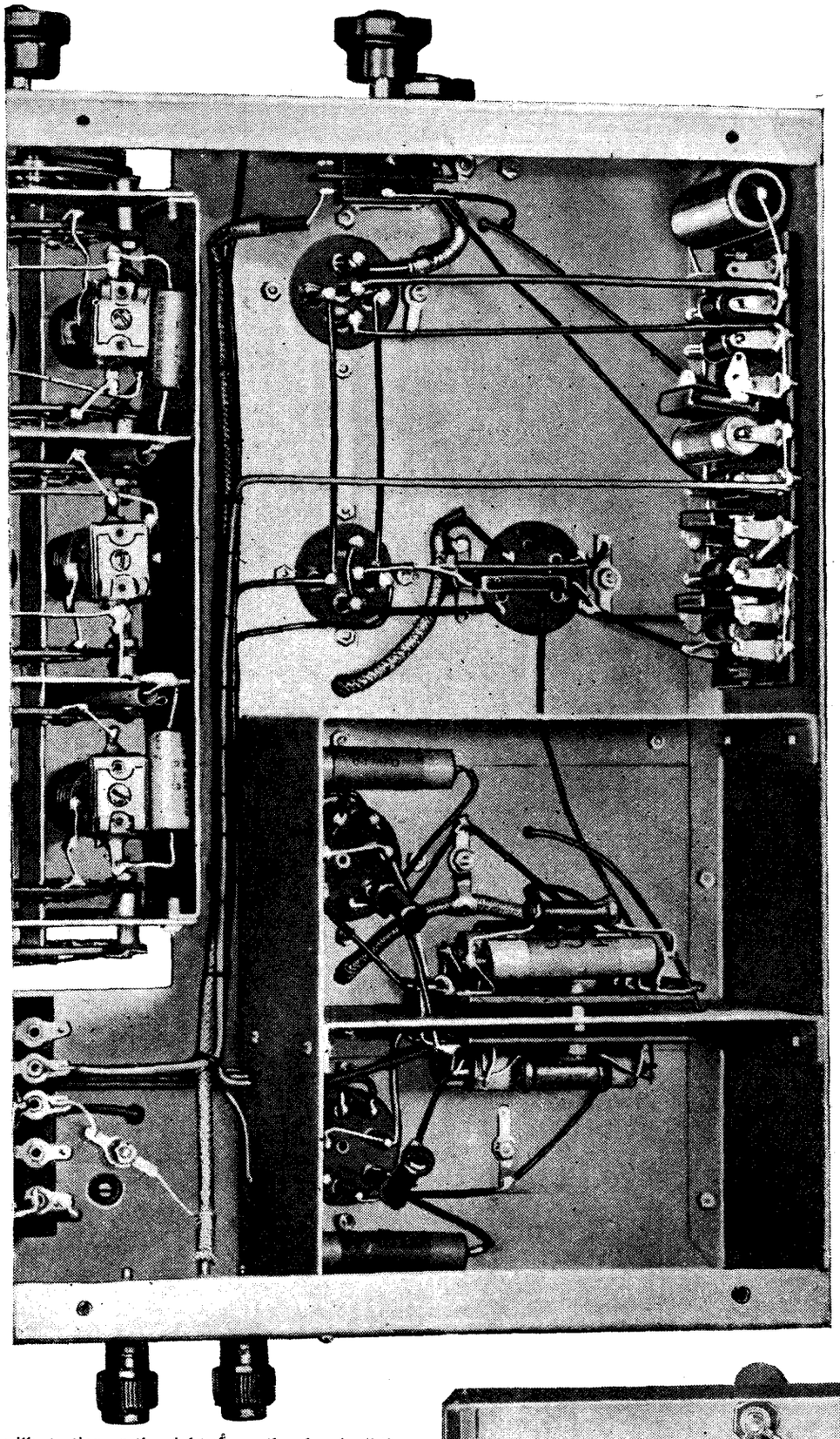


Details of the underside of the receiver and of much of the wiring can be gleaned from the above photograph, power unit from beneath.

Whichever is used, the meter will indicate a maximum current with no signal, and its reading will decrease when one appears, the current becoming lower as the signal increases in strength.

Connect the oscillator lead to the grid of the second IF transformer and adjust the two trimmers in T4 for maximum response—that is, the greatest sound from the loud speaker or the lowest current or voltage reading on the meter. Then transfer the oscillator lead to the grid of the first IF valve, and adjust the single trimmer in T3. The optimum setting will not be sharply defined, for this circuit tunes very flatly; the trimmer should be very nearly fully unscrewed.

The next step is to transfer the oscillator lead to the grid of the frequency-changer (top-cap, MX40), the wave-range switch



while the illustration on the right shows the chassis of the

being set for the long waveband. At the start, the selectivity control should be nearly fully rotated in a clockwise direction and the trimmers in T1 and T2 roughly adjusted for the greatest response. There are two trimmers in each transformer, accessible through rubber-bushed holes in the top and bottom of the screening can. Having made this rough adjustment, turn the selectivity control in an anti-clockwise direction so that the highest selectivity is secured, and carefully adjust each trimmer for maximum response.

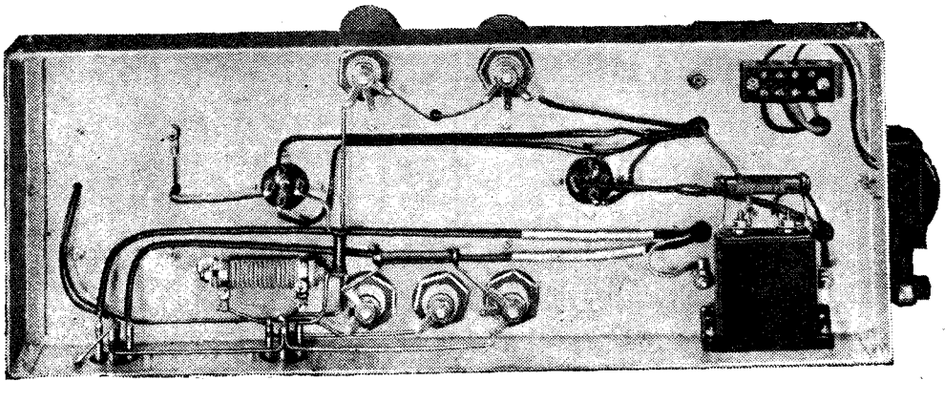
It is necessary to carry out these adjustments carefully, for the adjacent channel selectivity depends very greatly upon the accuracy with which they are made. The six trimmers in T1, T2, and T4 should all have definite optimum settings; the four in T1 and T2 being of roughly equal sharpness, and the two in T4 being also about equal but rather less sharp. The trimmer in T3, however, tunes flatly and the optimum is not well-defined; this is, of course, due to the low Q of this particular circuit.

The Controls

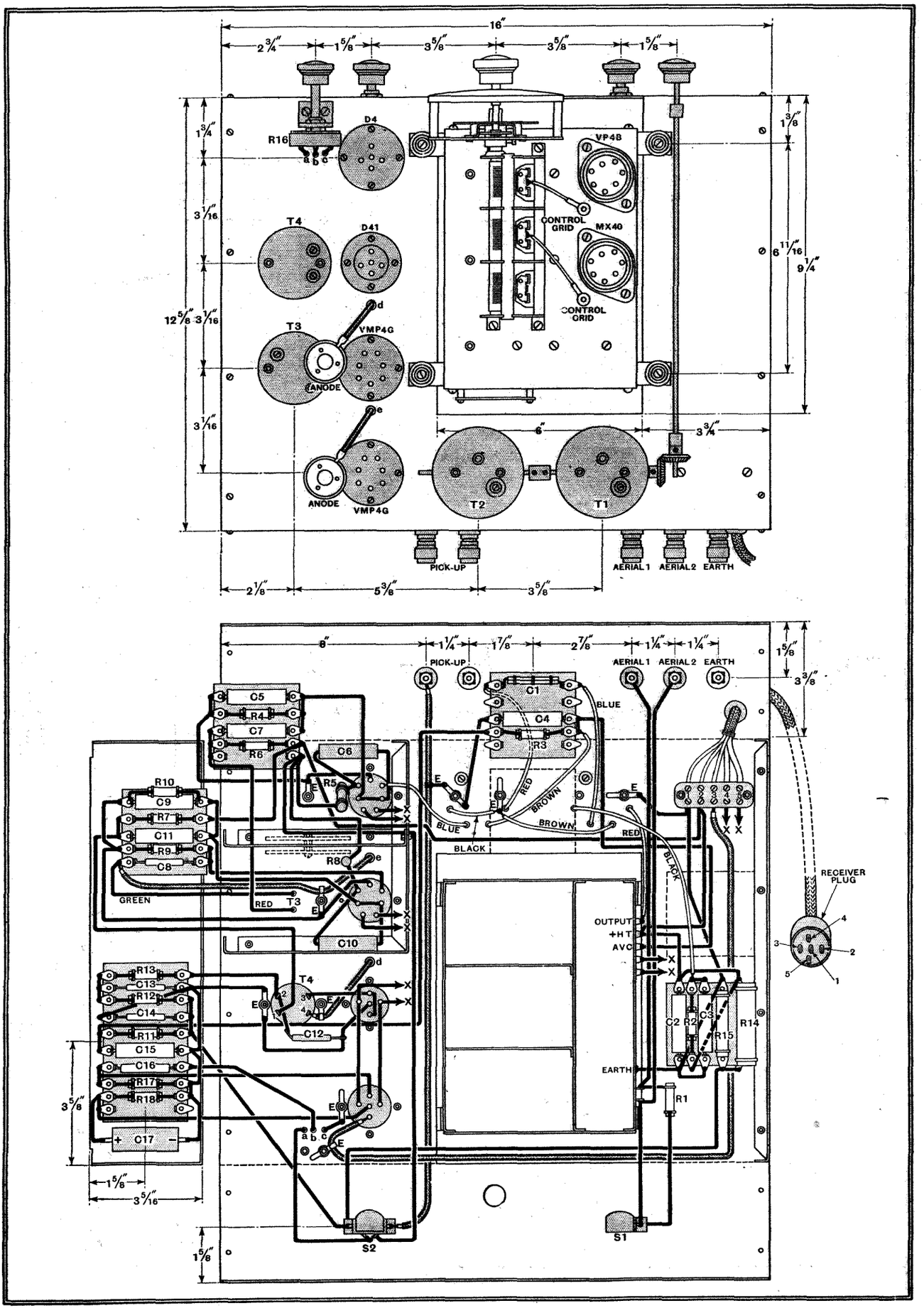
The adjustment of these circuits completes the trimming, for the ganging proper of the signal-frequency and oscillator circuits is already done, since the tuner is supplied ready ganged and under normal circumstances requires no adjustment by the user. The controls all operate in the obvious manner, save perhaps the wave-change switch. This has four positions, short-wave reception being secured in position 1 (fully anti-clockwise), *long wave* in position 2, and medium waves in position 3. The fourth position is not used in this receiver. It is actually intended for "Gramophone," but in this case it has proved more convenient to employ a separate switch for the change-over from radio to gramophone since very much shorter leads can be secured.

One other control is included which has as yet received no mention. This is the local-distance switch, S1. For general reception it is kept open, but when closed it connects the resistance R1 across the aerial terminals and so reduces the aerial input and prevents distortion through overloading when the set is tuned to the strong signal from a local station. It is somewhat in the nature of a refinement, and it may prove unnecessary in some cases; the nearer one is to the local and the more efficient the aerial, the more likely is it to be needed.

Little need be said about the operation of the receiver, for this is quite straightforward and differs in no way from that of any modern set. Selectivity should be kept close to maximum while tuning, and reduced as far as interference will permit once a station has been tuned-in in order to secure the best quality. It is almost im-



WIRING DIAGRAM OF THE RECEIVER

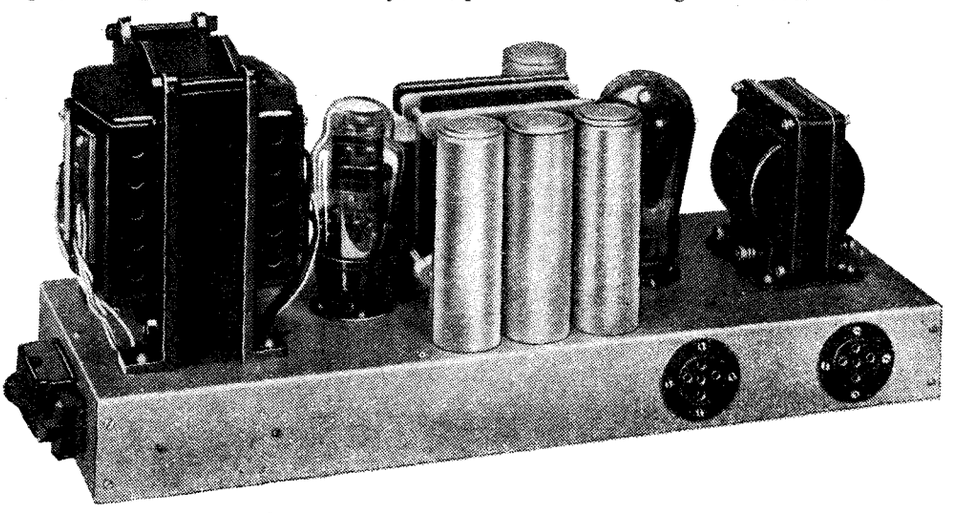


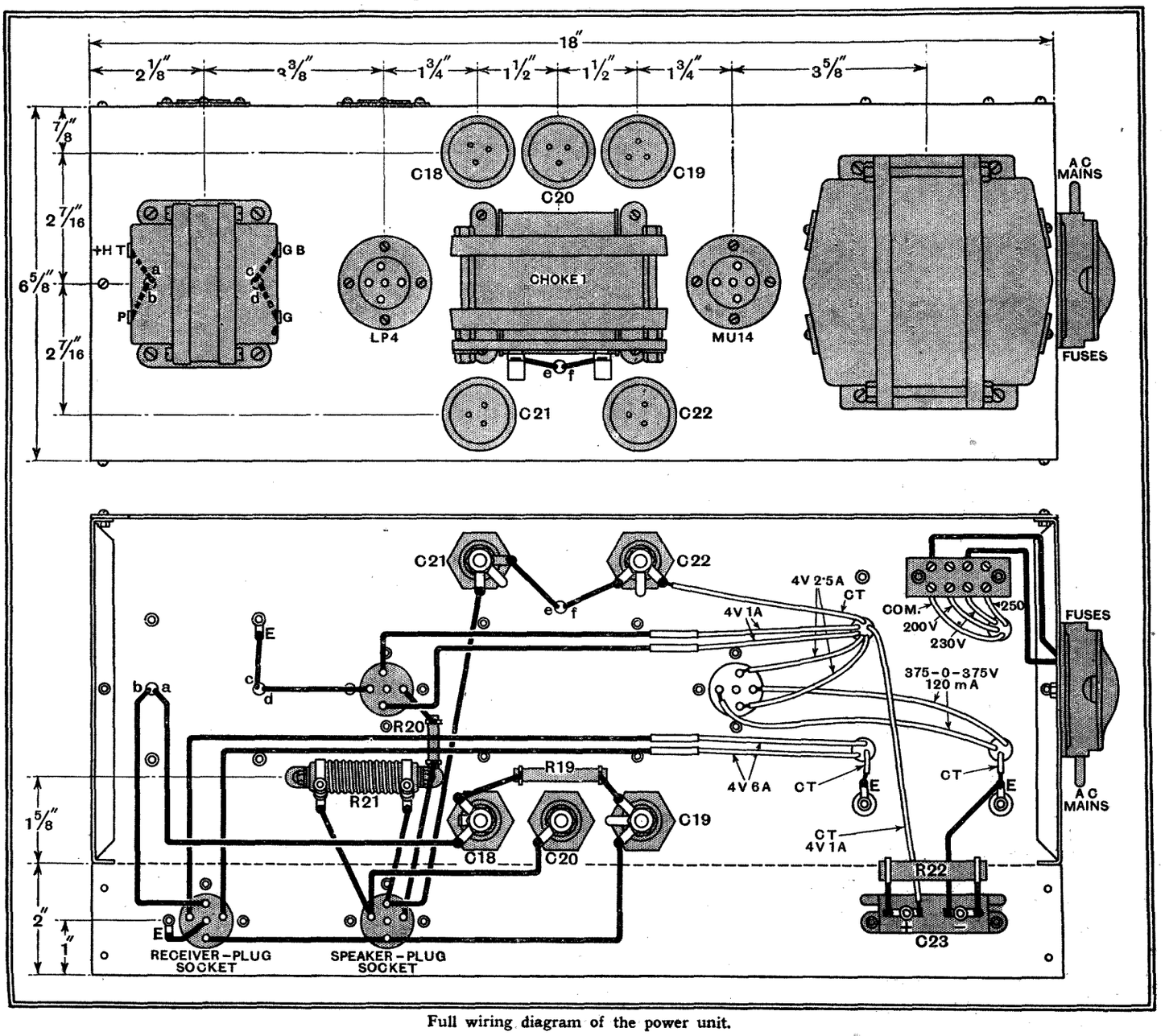
Complete constructional and wiring details of the receiver unit appear in this drawing.

All-Wave Super Seven—

possible to tune the set accurately at low selectivity and it should be noted that this corresponds to a clockwise rotation of the control knob. The wavelength calibrated scale is a considerable help in finding one's way about, particularly on short wavelengths, and it is reasonably accurate although not sufficiently so to render station identification by this means alone a certainty. It should be noted that on the medium and long wavebands a station calibration is provided in addition to frequency scales marked in kilocycles per second. On the short waveband, however, the dial is calibrated in megacycles per second.

On test, the receiver functioned admirably, the sensitivity being adequate for all normal requirements on all wavebands. The selectivity, too, proved to be of a high order, it being just possible in London to receive the Deutschlandsender clear of intelligible interference from Droitwich and Radio Paris. The quality of reproduction reached a very satisfying standard indeed, and mains hum proved negligibly low. The short wave range proved capable of yielding many distant stations under average conditions. During the daytime Rome on about 25 metres, and Zeesen on about 31.5 metres proved very strong signals on most days, and there were generally a number of amateur transmissions to be found around 40 metres. The





Full wiring diagram of the power unit.

All-Wave Super Seven—

American signals are not as a rule well received until the early evening, and, of course, are much more dependent upon the prevailing conditions. The 19-metre band, however, should provide the best results from this continent during the daylight and twilight hours, but after dark better results may be secured from stations operating on rather longer wavelengths.

Tuning on the short waveband is very sharp, and the control must be turned very slowly if weak signals are not to be passed over and missed. It is, however, by no means difficult, and anyone can handle it after very little practice.

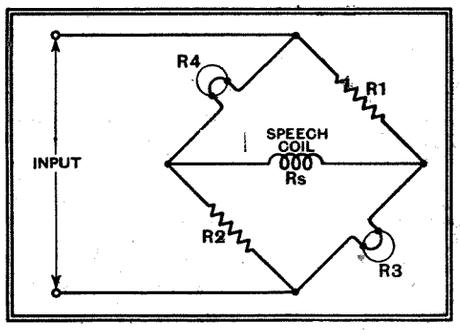
Separate full-size blue prints of the wiring diagrams of the receiver and the power unit are available from the Publishers, Dorset House, Stamford Street, London, S.E.1. Price 1s. 6d. each, post free.

Lamps for Volume Expansion

By R. H. TANNER

MANY readers have apparently found difficulty in choosing bulbs suitable for the simplified volume-expansion circuit described in *The Wireless World* recently. Since every different set of speech coil impedances and output powers involves different lamp ratings, it is impossible to give more than a few examples.

The table given below, however, suggests suitable lamps for sixteen common combinations of power and impedance. The impedances chosen represent both the



The volume-expansion circuit referred to in this note.

big high-quality speaker, normally 15 or $7\frac{1}{2}$ ohms, and the smaller type as fitted in sets (2 or $3\frac{1}{2}$ ohms). If there is any doubt as to the figure to use, the manufacturer of the set or speaker should be consulted. For cases not covered by the table the following formulæ should be used:—

$$\text{Voltage rating of bulb} = 0.94\sqrt{WRs}.$$

$$\text{Current rating of bulb} = \frac{1}{7}\sqrt{\frac{W}{Rs}}.$$

$$\text{Resistance of other arms} = 0.23 \times Rs = R1.$$

W = Output power.

Rs = Speech coil impedance.

It has not always been possible to find lamps of exactly the right rating, so that the values given are the closest approximations. In some cases better results might be obtained with slightly different values of R1. The list of lamps given is not exhaustive, but includes only those referred to in the table by the appropriate reference letters.

It should be pointed out that the resistance of the bulb as calculated from the ratings is its resistance hot. The cold resistance is smaller and will be about one-tenth of this value.

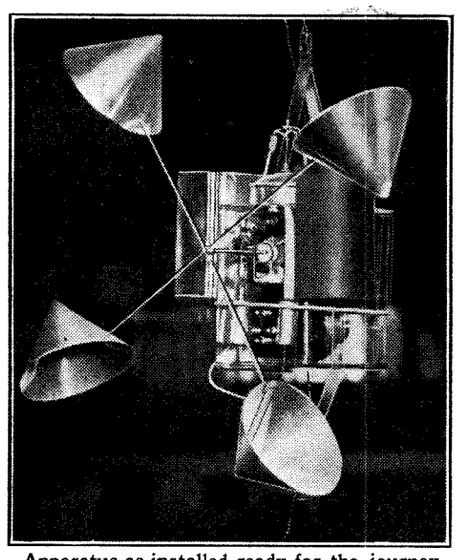
Output Power.	Speech Coil Impedance Rs.			
	2 Ohms (R1 = 0.46).	$3\frac{1}{2}$ Ohms (R1 = 0.8).	$7\frac{1}{2}$ Ohms (R1 = 1.7).	15 Ohms (R1 = 3.4).
$3\frac{1}{2}$ watts	A	E	—	2 H's in series
7 „	B	2 A's in series	2 E's in series	—
12 „	C	F	G	3 E's in series
30 „	2 D's in parallel	2 G's in parallel	2 F's in series or 4 B's in series	8 A's in series

Osram or Ever-Ready bulbs: A, 2.5 V. 0.2 a.; B, 3.5 V. 0.3 a.; C, 4.5 V. 0.3 a.; D, 7.3 V. 0.3 a.; E, 3.5 V. 0.15 a.; F, 6.2 V. 0.3 a.; G, 8.0 V. 0.2 a. **Competa bulb** (Bulgin): H, 4.0 V. 0.06 a.

NOTE.—The data above refer to one of the two similar arms. Thus at least **two** bulbs are needed, one for each arm. Two resistances, each equal to R1, of which the ohmic value is given in the table, are also required.

SOUNDING THE STRATOSPHERE BY WIRELESS

MODERN weather prophets have long ago realised the importance of investigating the upper layers of the terrestrial atmosphere. For this purpose, so-called stratosphere balloon flights have been undertaken, of which those by the Belgian scientist, Professor Piccard, have gained a world-wide fame. Such experiments are, however, not only dangerous, but also rather expensive. It is obvious that the sending up of automatic register-

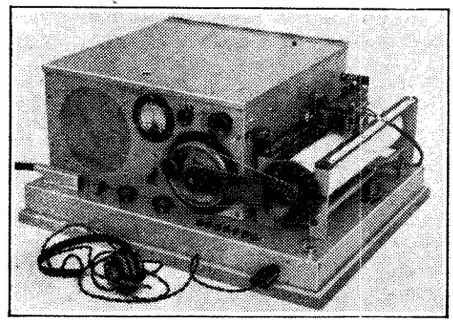


Apparatus as installed ready for the journey of exploration. This equipment, which includes the transmitter, is suspended from the balloon.

ing apparatus is both cheaper and more effective, because a balloon of smaller size is able to ascend to higher altitudes.

The construction of such recording apparatus has busied the minds of a great many scientists and engineers with the result that several types of "wireless recorders" have been invented. One of the most ingenious of this kind was constructed some time ago by the director of the Finnish Aeronautical Bureau at Helsinki, Dr. Vilho Väisälä. It operates on several variable wavelengths and in this respect possesses a great advantage over those using one permanent wavelength.

The principle on which the Finnish apparatus works is that every measuring instrument controls a variable condenser, so that variations of capacity are equal to values of the corresponding meteorological element. The capacities of these variable condensers are combined and compared with those of two permanent capacities by means of a midget transmitter. These condensers are situated in the oscillator circuit of the transmitter so that its carrier wave is altered according to the values of the capacity.



Photograph of the equipment on which is recorded the transmission from the midget transmitter installed in the exploring balloon.

The signals from the midget short-wave transmitter are received below by means of a special receiver, all variations of wavelengths being recorded. The capacities of the controlling condensers can then be calculated from the wavelengths. As the recording instruments have previously been compared with absolute instruments in the laboratory, air pressure, temperature, etc., can easily be measured at various altitudes up to 30,000 metres.

CURRENT TOPICS

EVENTS OF THE WEEK IN BRIEF REVIEW

N.B.C. Network Extension

FIVE new broadcasting stations on the Pacific Coast have been acquired by the American National Broadcasting Company, this bringing their total of stations up to a hundred and fifteen.

What's in a Name

IT is reported that the Government of India has decided to change the name of the Indian State Broadcasting Service to All-India Radio. This is part of a plan for popularising radio in the villages, as the long official title was not generally welcomed. Another step which has been taken towards popularising radio is the giving of more frequent broadcasts by entertainers of a type with whom the villagers are familiar.

Poste Parisien Television Transmitter

STILL more television activities are contemplated in France. The well-known "Poste Parisien" has now completed the installation of a television transmitter using 180 lines. It is noteworthy that the Poste Parisien shares the opinion of certain other French television interests that the "intermediate film" method of transmission is the only one worth considering at the moment, direct methods being regarded as insufficiently developed. The newly-installed transmitter uses a power of 40 watts and a wavelength of 7.5 metres. The accompanying sound is also sent out at the same power and on 7 metres. The station is intended mainly for experimental purposes, and a regular programme service is not at present contemplated.

Olympia Rejuvenated

IT is now ten years since the annual wireless exhibition, after finding temporary headquarters in various parts of London, finally settled down. For the past few years the exhibition has filled two of the three halls which constitute Olympia. This year visitors will find considerable improvements, for all three halls have been renovated at a cost of a quarter of a million pounds. Those who find themselves rather dusty and dirty after an all-day trek round the stands will, if they desire it, be able to take a bath. In addition, there is now available greatly improved restaurant accommodation. The Addison Road entrance has been entirely remodelled and a vast vestibule constructed, whilst an enclosed walk, one hundred and sixty yards long, will provide shelter for those bound for the Hammersmith Road entrance. Additional buildings, including a new garage, are also being erected.

Irish Interval Signal

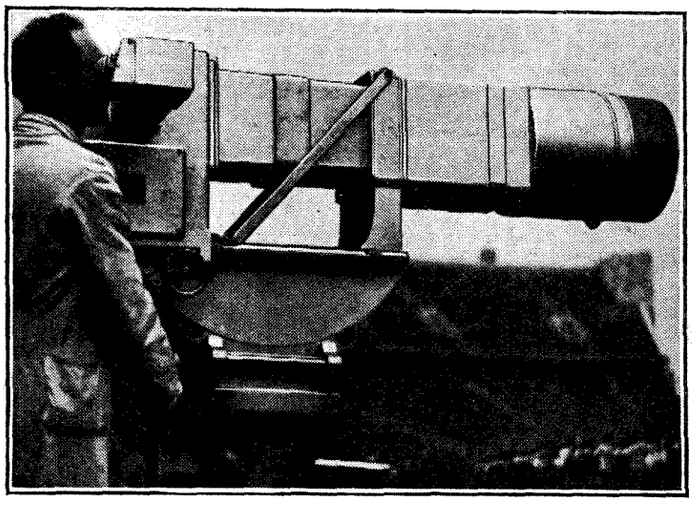
IT is reported from Dublin that the apparatus for providing the new interval signal for Irish stations has been sent back to its German makers for modifications. It is hoped that these alterations will be completed within a week or two and that the apparatus will arrive back in Ireland some time during the present month. The signal will consist of an old Irish air.

Police Radio

STRIKING advances have been made in the use of radio for the detection of crime and nowhere in this country is this more apparent than in Liverpool. A special type of bicycle receiving set has been developed to work in conjunction with the police transmitter. These bicycle sets employ two valves and weigh about 30 lb. A site has been selected for a new transmitting station to co-operate with the mobile receivers as the present transmitter is not entirely suitable. Motor cycle combinations fitted with radio are also being employed in the city's crime detection campaign.

France to Follow the B.B.C.

AT the fifth National Broadcasting Congress recently held at Grenoble it was announced that the French P.M.G. has prepared a plan for the entire reorganisation of State broadcasting. At present French broadcasting is regulated by a number of bewildering Government decrees, some of which are stated to be more or less contradictory. It is said that the French P.M.G. proposes to sweep all these decrees away and establish broadcasting on as firm a basis as the B.B.C.



Direct scanning television camera in action during the recent Olympic Games. It was reported that owing to dull weather the results were rather disappointing and that the transmissions by means of the intermediate film process provided a pleasant contrast. The experiments were carried out by the German Post Office.

New Idea for U.S.S.R.

AS an alternative to the linking of distant provincial stations to Moscow by land-line for simultaneous broadcasting, it has been decided to record on film all important broadcasts, other than those of a purely topical nature, which take place from Moscow and other large centres. These records will be sent to distant parts of the Soviet Union to be broadcast at times convenient to the local stations. This is considered a great step forward as, owing to the huge range of longitude covered by the U.S.S.R., some parts of it differ from Moscow time by several hours, thus rendering simultaneous broadcasting very inconvenient.

German Amateurs Disgruntled

AS many listeners are aware, transmitting licences are now issued to amateurs in most European countries, although the restrictions governing them are very severe in some parts of Europe. In Germany amateurs are forbidden to use telephony, morse being the only method of communication allowed. German amateurs have long felt a sense of grievance at this state of affairs, and it is rumoured that a movement is afoot to get the ban on speech removed. It is to be hoped that success will be achieved, as responsible amateur transmitters have long since proved their value to the progress of the science of radio.

Chinese Broadcasting

PEOPLE in this country who as a matter of principle are "again the Government" would certainly have something to bite upon if they lived in China, for it is reported that the Government there has just stepped in and commandeered the most popular evening broadcast hour for the purposes of political propaganda. All stations, whether operated by Chinese or foreigners, are to set aside this hour every evening for an official spokesman who will discourse on topics chosen by the Nanking authorities. It is an ill-wind that blows nobody any good, however, and it is stated that wireless dealers have welcomed the Government action with open arms, since already a great rush has commenced to purchase receivers capable of bringing in programmes from foreign countries.

Herts Bans Noisy Loud Speakers

YET another county has passed a by-law against the inconsiderate use of loud speakers. This time it is Hertfordshire, and it will be only necessary for three householders to make a complaint for a summons to be issued. Failure to comply with an order to abate the nuisance within fourteen days will result in a £5 fine.

A Curious Accident

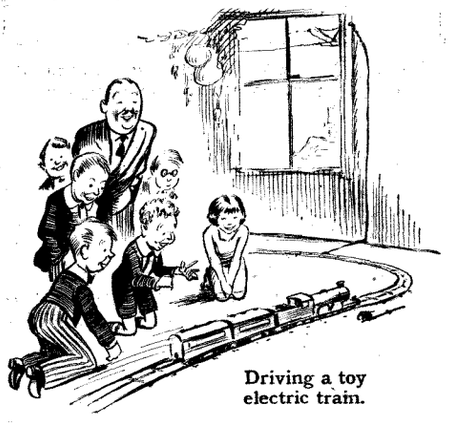
A MOTORIST in Denmark recently had the misfortune to damage nearly one hundred all-mains sets and a large quantity of electric light bulbs owing to a remarkable accident. He collided with a post which was carrying three electric light cables feeding a group of houses by means of the three-wire system, the two "outers" being at a potential difference of 440 volts. The centre wire broke, and that end of it which still remained connected to the houses came into contact with one of the outers. The result was that one section of houses had their power cut off altogether and the other section received double voltage. By a curious coincidence the motorist happened to be on his way to buy a new set, but he little thought that he would implement the purchase of a hundred instead of one.

UNBIASED

The B.B.C. and Petty Pilferers

IT has often been observed that after a new broadcasting station has been in operation for a few months it fails to fulfil its early promise, and signal strength falls off to an alarming extent. Many are the high falutin' scientific theories which have been advanced to explain away this phenomenon, the favourite one being a rise in earth resistance due to some obscure electrolytic action. It has, however, remained for a reader of *The Wireless World* to reveal the true reason for this unfortunate state of affairs.

He has been moved to write to me owing to my recent notes concerning sparks jumping across the broken guttering of a house built under the shadow of a broadcasting station (19.6.36), these electrical discharges being due to the picking up of energy from the transmitting aerial. Naturally, the energy thus picked up will be greatly enhanced if a tuned circuit is rigged up to collect it, and it appears that a neighbour of his, whose house is fortunately situated for the purpose, rigged up a large low-loss aerial arrangement and now uses the energy thus obtained to do various odd jobs around the house, such as operating electric bells and driving a toy electric train.



Driving a toy electric train.

This deliberate stealing of B.B.C. energy was first observed owing to the fact that particularly bad fading was noticed from the station in question on those afternoons when there was a children's party in progress at the house, the rise and fall of signal strength coinciding with the starting and stopping of the toy trains, which are, of course, always in great demand at such times.

It appears that since that time others whose houses are also fortunately situated have indulged in similar petty pilfering, which is now reaching alarming proportions. Naturally, this sort of thing can't be kept secret, and already our old friend the jerry-builder is demanding premiums for houses on "estates" which are in sufficiently close proximity to a B.B.C. station.

There is, I believe, no provision made in the laws of this country whereby these petty pilferers can actually be indicted for their nefarious acts, it apparently being no offence to abstract energy from the air in this manner; in fact, the law is actually on the side of the malefactors, as it so often is, and did they care to do so they could actually obtain an injunction against

By FREE GRID

the B.B.C. compelling it to prevent its surplus energy straying on to their premises. The only thing left for the B.B.C. is to buy up all the land within a certain area around each station, although, I would hasten to add, this is not the reason why it is so feverishly acquiring all the property in the vicinity of Portland Place.

When 5 per Cent. is 10 per Cent.

HIGH finance is an intriguing science, but I regret to say that it has always been far beyond the grasp of my limited intelligence. I have always been an ardent admirer of those practical exponents of it who continue to drag through life living on their losses and hardly knowing where next year's Rolls-Royce is coming from. It is indeed fortunate that the radio trade is happily free from the need of studying these higher mathematics—at least, the manufacturing side of it—for, of course, the members have always been able to sell so many sets during the first hour of the annual Olympia exhibition that they have no need to go in for high finance in order to keep body and soul together.

In spite of all this I cannot help thinking that there are some members of what I may call the large dealer branch of the wireless trade, more unfortunate than their fellows, who are compelled to resort to mathematics in order to keep the wolf from the door. Several instances of this sort of thing have been brought to my notice by readers and I have picked one instance at random from among my correspondence to show you the sort of thing I mean. My correspondent, who is quite an average sort of man, took advantage of his wife's temporary absence last year to squander about forty pounds on a super sort of radio-gramophone. As a matter of fact the sum wasn't exactly forty pounds, but I have purposely reduced everything in this little tale to round figures because I know that you, like myself, prefer that things be made easy for you to understand.

Well, as I have said, my correspondent

The first hour of the Annual Olympia Exhibition.

spent his forty pounds, and this year he covets yet another de luxe instrument at the same price. Now it so happens that the particular merchant from whom he bought last year's set is one of those who are willing to receive the price of his goods by that method which, by some strange misnomer, is known as the Easy Payment System. Those who desire to take advantage of this system and spread their payments over a period of a year are charged a modest 5 per cent. for the service.

Now, among other strong "selling points" of an almost universally adopted type is the taking of old models in part exchange. My correspondent, realising that last year's wireless sets have a relatively small value from the selling point of view, was rather hesitant about offering his set in part exchange, and he was considerably astonished when the dealer offered him half-price, namely, £20, for it. Making a feverish calculation he found that he had a total of £20 actual cash left to pay, to which he added an extra 5 per cent., or, in other words, £1, for the convenience of paying it off in twelve monthly instalments.

He was loud in his praises of the firm's generosity, but was solely puzzled when he received a statement of account in which the interest was charged up as two pounds instead of one pound. Thinking that a mistake had been made in thus charging him 10 per cent. instead of 5 per cent. interest on the twenty pounds cash which he owed the firm, he ventured to point this fact out in a letter. In their reply the firm indignantly repudiated the suggestion that they had been so grasping as to charge 10 per cent. like certain other firms they knew of. The explanation was very simple, the 5 per cent. being charged on the forty pounds instead of on the twenty pounds cash outstanding.

I suppose that, as I have mentioned before, it is my unfortunate ignorance of high finance that prevents my seeing this in the light in which I am told all the best people look at it. Old-fashioned as it is to do so, I cannot help entertaining a sneaking sort of liking for the firms who charge a definite take-it-or-leave-it 10 per cent., and the opposite feeling for firms who charge exactly the same amount but, by means of a bit of high financial juggling, permit their intending customers to believe that they are going to pay only 5 per cent. What do you think?

HINTS and TIPS

Practical Aids to Better Reception

IN many DC or universal sets, especially those of a few years ago, the pilot lamp is wired across a resistance connected in series with the chain of valve heaters. As a result the lamp tends to glow with abnormal brilliance for some time after switching on, because the heaters are of low resistance until they warm up. Unless there is some form of regulating device, the lamp may then have a very short life, especially if its rating is such that it still gives adequate illumination to the dial when the valves have attained their normal temperature.

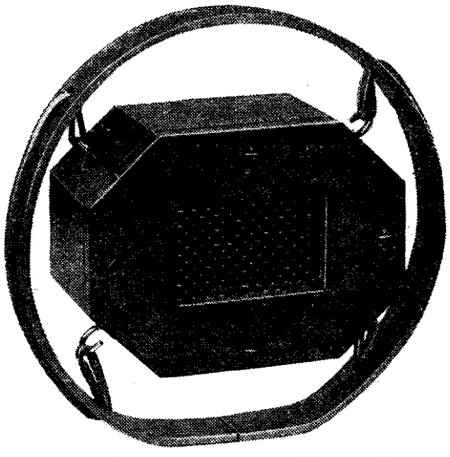
Long-life Pilot Lamps

Where frequent failures of the pilot lamp are encountered in these circumstances it is often worth while substituting an ordinary lamp, say, of 5-15 watts, rated at the full voltage of the mains. This, of course, is joined across the mains input on the "dead" side of the on/off switch.

ALTHOUGH the output from a transverse-current microphone is comparatively small, the sensitivity is quite high, especially to mechanical shocks, so it is customary to mount it in a shock-proof holder. A mounting of this nature is not difficult to devise, and one made to take the microphone described in the *Wireless World* of January 11th, 1935, is shown in the illustration.

Microphone Support

It consists of a piece of $\frac{3}{4} \times \frac{1}{8}$in. brass strip cut to a length of 19in. and bent to form a circle with two "flats" for screwing to a wooden base, though it could, of course, be easily fixed to a table- or floor-type stand.



Shock-proof suspension for the *Wireless World* microphone.

Four $\frac{1}{4}$in. holes are drilled at suitable points and two stout rubber bands threaded through them are stretched over hooks screwed into the microphone case.

These bands should be 3in. in diameter and not thinner than $\frac{1}{16}$in. Either round or square section may be used.

This makes a perfectly satisfactory support, and it will stand any amount of jolting, as was recently demonstrated by using the microphone so mounted with a portable ultra-short-wave transmitter fitted in a car.

ALTHOUGH a prolonged heat wave is seldom experienced in this country, it is perhaps excusable to remind readers that dry batteries are adversely affected by high temperatures. Heat causes the electrolyte to dry up, and shortens the working life of each cell; for this reason special batteries are produced for use in tropical countries.

Care of Batteries

Where a receiver stands on a table with its back to a window, the sun's rays reach the HT battery and hasten materially the end of its useful life. In fact, cases are not uncommon where a new battery, almost unused throughout the summer, has been found quite useless by the autumn. The obvious remedy is to move the set temporarily into a more shady position.

Accumulators, too, whether LT or HT, are naturally more subject to evaporation in summer than in winter, and consequently need more frequent topping-up to preserve them from premature deterioration.

By contrast, the chassis of the receiver itself may actually benefit from prolonged exposure to strong sunshine, for with battery sets, unlike mains sets, which always run at such a high temperature that moisture is automatically baked out, long spells of damp weather tend to have an ill effect on sensitivity, which may remain for some considerable time afterwards.

IN a standard valve base (seven or nine pins) often one or more of the pins is a blank. The set manufacturer may remember this fact when arranging a practical lay-out, and is tempted to use the blank socket of the valve holder as convenient anchorage for a soldered joint standing at a high DC potential. Without defending this practice, it is as well to bear the possibility in mind when looking for faults and to disregard for the moment any voltage reading obtainable from a pin that should be "Dead." In battery sets especially an unexpected high voltage with insufficient protective resistance in between may have injurious results to a good test meter; this emphasises the need for caution and the use of the highest convenient range of the instrument, at any rate for preliminary measurements.

Seven Pins

MOST sets embody some form of tone control which cuts the high frequencies, but it is comparatively rare to find provision for attenuating the bass as well. Nevertheless, it is often an advantage to be able to vary the amplification in the bass region independently of the high notes, particularly when listening to speech, which frequently sounds hollow and unnatural when reproduced at the average B.B.C. programme level. Also, when dealing with short waves especially, the reception of a weak distant station with the set "all out," or using critical reaction, can sometimes be cleaned up considerably by cutting the bass below about 250 cycles.

Variable Bass Response

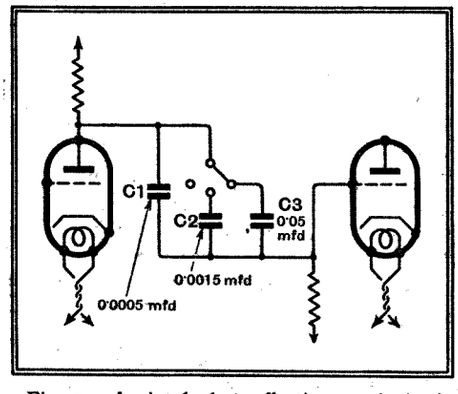


Fig. 1—A simple but effective method of controlling response in the lower register.

Resistance LF coupling being almost standard practice nowadays, probably the simplest form of variable bass control is a switch selecting different values of coupling capacity; Fig. 1 makes the arrangement quite clear. The lowest capacity, C1, remains permanently in circuit, the other two (or more) condensers being switched in parallel, one at a time. Suitable rotary selector switches are now easily obtainable.

It is not suggested that the values shown are the best in every case, but they have been found to work very satisfactorily in a circuit using Marconi MHD4 and N41 valves.

When the LF coupling is by parallel-fed transformer the total coupling capacity in the maximum bass position may with advantage be calculated to resonate with the transformer primary inductance, in order to produce the greatest possible contrast between the maximum and minimum positions.

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

A Wireless World Set

MAY I congratulate you on the excellent results I have obtained with your Olympic S.S. Six, having now had the opportunity of testing the set over a full twelve months. We have several difficulties in this town, such as trackless tram, the separation of the North Regional, etc., all of which are entirely overcome by the Olympic Six. The tone qualities are excellent.

I have recently been asked to recommend one of the sets on the market to a musical friend; before doing so I tried out several makers' sets in the same room as the Olympic Six. In all cases the results expressed were the same, "This is a wireless (makers' set) and that isn't" (meaning the Olympic Six). This, I think, expresses the results in a very few words, as I have never heard such faithful reproduction.

You may publish this letter if you think it of interest to your readers.

Darlington. A. J. W. CUDHAM.

Biasing the Output Stage

IN his letter in the issue of July 31st, Mr. Bonavia-Hunt makes some rather curious statements anent the use of electrolytic condensers for bias decoupling purposes, and the audio frequency attenuation resulting from automatic biasing schemes in general.

Let us consider the points raised without dwelling too long on 100-mfd. paper condensers.

Electrolytics of this capacity have been available for a considerable time, are relatively cheap, can be obtained for working voltages up to at least 120 V, lead to no loss of valve life whatever, and, finally, are responsible for such a negligible loss at 30 cycles that the loss would be absolutely unnoticeable by a normal human being at 25 cycles, which is usually considered a reasonably low audio frequency. It may be stated here that the power-handling capacity of all normal loud speakers is not great at the latter frequency.

Not content with this, however, Mr. Bonavia-Hunt has an arrangement to boost these frequencies, and uses in place of one condenser, two condensers and one iron-cored choke in an intermediate stage, where bias values are low and it is possible to use a value of 250 mfd. if lingering doubts exist as to bass loss.

Perhaps in these circumstances Mr. Hunt will be good enough to enlighten the writer with some additional and more cogent reasons for his statement that a rising bass characteristic is either necessary or desirable, from the viewpoint of fidelity of reproduction. The writer can see no reasons in radio reception, and is aware of many more suitable methods for compensating the loss occurring in record reproduction.

Wallington, Surrey. L. C. IRVINE.

The "Russell Effect"

I WAS intensely interested to read in *The Wireless World* Mr. Russell's letter describing his discovery of the self-called "Russell Effect."

Mr. Russell suggests that the two signals are "mixed" in the receiver; he might be right, but I would, with all diffidence considering my limited knowledge, suggest that the two frequencies are "mixed" in the ether before arriving at the receiver.

In the same way I have often had occasion to think that the cause of fading is due to this "mixing" of one, or more, or a score of different signal frequencies coming into and going out of phase in the ether. If there were only one broadcast signal in the world being transmitted at one time, I venture to suggest (again with all diffidence) that this sole signal would not fade in the usual way.

This means that I am disputing the Heaviside Layer theory, which I cannot disprove to prove my own theory. I wish I could!

CHARLES HAWKINS.

Lower Mitcham, Surrey.

YOUR correspondent, O. J. Russell, has announced his discovery of the "Russell Effect" rather late.

Early this year, in co-operation with a friend of mine, I carried out a few experiments with three super-regenerative 5-metre receivers. Our local 56 megacycle oscillator never gave rise to the phenomena as described by Mr. Russell, but we found that with one particular design, when coupled to a half-wave aerial with a matched impedance line, our signals consisted entirely of amateur transmissions from the 40-metre band. Used with a vertical half-wave aerial terminating in a single loop at the receiver end, the trouble disappeared.

Harmonics were first suspected, but careful checking revealed some doubt; then we thought that the U/S chokes were resonating but replacement with several different windings made no change. The other two receivers functioned normally, but with this particular one several G's and French amateurs were heard; the best reception was from G5AU (?), of Forest Gate. Alterations to the potentiometer supplying HT to the quench valve shifted the carriers to a different position on the dial.

All our tests were carried out beneath an aerial system which consists of a 40-metre doublet 30 feet high, and two inverted V's, each resonant at about 20 metres, one directional to North and the other South. We then suspected that conditions local to the receiver sponsored the peculiar effect and alternately the aerials were grounded or lowered during tests, but once again no alteration in performance could be detected.

Our interest has been aroused by Mr. Russell's experience, as it is similar in many respects to ours.

Possibly some other readers encountered such conditions; if so, it would be interesting to hear from them through the medium of your journal. C. T. CLARK.

Staines, Middx.

THE letter by Mr. O. J. Russell, in *The Wireless World* dated July 31st, calls to my mind a somewhat similar but more mystifying experience which occurred when a friend and I were trying out a single-valve 5-metre receiver, using the split Colpitt's circuit.

We were surprised to hear a number of medium-wave stations at good strength, which could be tuned in as on a broadcast receiver, *i.e.*, it was possible to heterodyne them by making the receiver oscillate. The receiver, incidentally, was perfectly stable, and did not appear to generate parasitic oscillations; moreover, the effect occurred only in the friend's house, normal operation being obtained at my address.

We never discovered the explanation, but it is as well to add that in the first instance HT was taken from DC mains (positive lead earthed), while I used an AC supply.

Ipswich. G. W. GREEN, 2BDG.

What the Public Wants

A Reader's Reply to a Manufacturer

AS a member of the public for which Mr. Hartley is supposed to cater, I must say at the outset that if other manufacturers base their opinions upon the same false assumptions which actuate your contributor regarding what the public "wants," then the outlook for the further progress of the radio industry is not very hopeful. I can only hope that there are manufacturers who have the ability to keep in closer touch than he apparently does with the buying public!

I have read the article "Whither Exhibitions?"* twice, and in it, like stubbing one's toe on something in the dark, have come upon the detestable phrase about "educating" the public to buy better—*i.e.*, more expensive—sets. What this means precisely I am not quite sure, but I undertake to enter the matriculation standard at one bound if Mr. Hartley will hand me a few five-pound notes! The average man, you see, cannot afford to pay much for anything, not even a radio receiver, and cheap sneers at his inability to do so will not prevent his buying low-priced (but not necessarily "cheap") products. The trouble, of course, is that the unfortunately vital matter of money has always the last say. Theoretically, everybody should have the best that industry has to offer, and nothing but the very best should be made, but in practice very few among us are able to afford £50 or more, which is what a really good set must inevitably cost to produce. Under the circumstances, therefore, the big firms which produce low-priced receivers are at one and the same time putting money in their pockets and performing the valuable service of placing broadcasting within the reach of nearly everybody.

I dislike the assumption that all cheap sets are necessarily poor in quality of reproduction. In the early days of wireless this was

* See *Wireless World*, July 31st, 1936.

What the Public Wants—

true, for obvious reasons, but to-day a set costing, say, "£8 19s. 11¾d.," to quote your contributor, would a few years ago, if it had been available then, most certainly have cost at least £20, or, rather, *guineas*! Mass production, which is so often despised, is a boon to the poor and the not-so-poor, and does not of necessity result in inferior goods, whether cars, or radios, or perambulators. Naturally, I would not attempt to deny the fact of the existence of large firms manufacturing (if such a word can be used) "tens or hundreds of thousands of sets in a year," of poor quality, or that such receivers are not sold in large numbers. There will always be undiscriminating people who find nothing wrong in a reproduction like that of an old-time phonograph, and they certainly need educating in the real sense of the word, but I do object to the implication that only expensive receivers should be made, as cheaper ones are incapable of giving a good account of themselves. To-day it is possible to buy a receiver of a good make, priced as low as 11 guineas (not "£15"), with the following features: A.V.C., tone control, high selectivity and great range, pick-up jack, and extra loudspeaker sockets, illuminated dial and visual tuning, *moving-coil speaker*, and last, but not least, economical running and a well-constructed and handsome cabinet! When you remember that even to-day sets can be bought costing over 100 guineas, 11 guineas is certainly "cheap," but the receiver equally certainly is not! A moving-coil loudspeaker used to be an expensive luxury, now it is incorporated even in low-priced battery sets, with a consequent vast improvement in tone, and, now that valves are at last to be cheaper, I predict that sets of the same quality as the one instanced will also be reduced in price, and thus be brought within the reach of still more people who appreciate tonal quality but are not "educated" enough to be able to afford the extra few guineas at present charged for good products.

Ignoring Potential Customers

Let us turn our attention to radio exhibitions. It has long been my complaint that too many manufacturers concentrate almost exclusively upon mains receivers, and ignore the existence of the battery set owner. This is very bad policy and shows a deplorable ignorance of the wants of the public. With electricity supplies in the chaotic state that they are, with the wide variations in voltages, current, and charges, many people who have electricity in their homes still run their sets off batteries, and of course there are the thousands whose homes are without electricity or whose supply is useless for the purpose of working radio receivers. Yet, to judge from the advertisements, all that the public is interested in is the mains receiver! And at this year's exhibition at Olympia the same mistaken policy will be followed of ignoring thousands of potential puchasers.

Another mistake which will be made this year will be the displaying of receivers which require external aerials and earths for their successful operation to the almost complete exclusion of self-contained models. Now, I shall draw down upon myself the wrath of hundreds of experts by what I am about to write, but nevertheless I declare my firm conviction that receivers dependent upon these external aids to reception are out of date and should be as dead as the proverbial dodo! The only exception I would make in favour of these irritating accessories is in regard to short wave reception, and even here the manufacturer should always have as his fixed aim and object the abolition of these anachronistic appliances, and the making of receivers for all ordinary domestic purposes as self-contained as the suit-case portable is to-day. The manufacturer of only the "anchored" type of receiver appears to forget entirely that for some years past more and more people have been taking up their abode in flats, where it is often impossible to fix up external aerials and earths for one reason or another. But you would not gather this impression from catalogues and Press announcements, in which "aerials and earths" seem to be trailing about on every page! Pye Radio, Ltd., are one notable exception to the general rule, for they specialise in self-contained sets, and, as a user of their products, I can safely say that anything which may be lost in range—and it's nothing to worry about—is more than made up for in convenience and a sense of freedom, while quality does not suffer in the least.

One other point in regard to advertisements. Some manufacturers of battery receivers are very fond of quoting a price, adding, "without batteries"! This is just as ridiculous as an advertisement for a car, containing after the price the statement "without engine"!

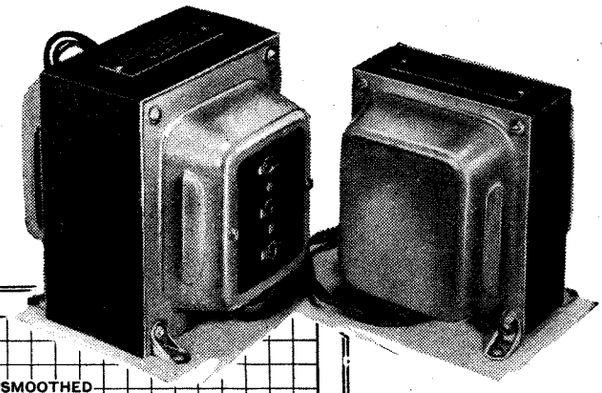
I have expressed my views as a member of the public, and can only hope that the publicity given to them by the wide circulation of *The Wireless World* will bear some fruit.

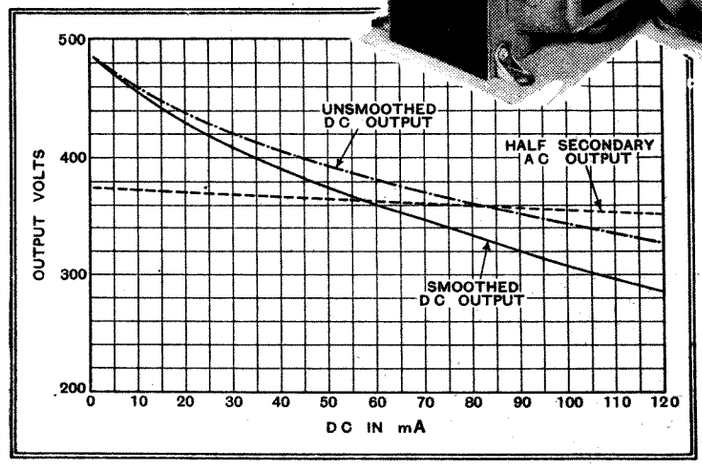
Sound Sales Mains Components

Tests Under Working Conditions

THE mains transformer and choke illustrated are specimens from the new range of constructors' models just introduced by Sound Sales, Ltd., Marlborough Road, Upper Holloway, N.19. The transformer, which is described as the type X3512, has three LT windings in addition to one for the HT rectifier, these being rated at 4 volts 4/5 amps., two at 4 volts 1 amp. and 4 volts 2.5 amps. respectively. The HT secondary is wound to give 350-0-350 volts RMS at 120 mA. All windings have centre taps. The primary is tapped for supplies of 210, 230 and 250 volts at 50 c/s.

The smoothing choke is a 25-henry model, also rated to carry 120 mA. of DC, as it is intended to be used with the X3512 mains transformer.





Sound Sales mains transformer, type X3512, and 25-henry smoothing choke, model H2512, together with output curves of the mains transformer.

For the purpose of test both components were embodied in an orthodox HT supply circuit, using a 4 mfds. condenser after the rectifier valve and one of 8 mfds. following the smoothing choke. Resistances giving the equivalent loading of valves were joined across all LT windings apart from the rectifier, which was an Osram MU12. Only 4 amps. were taken from the 4 to 5-amp. winding.

The smoothed DC output was measured with different current loads up to 120 mA., while simultaneous readings were made of the AC output from each half of the 350-volt secondary. The curves obtained from these measurements are shown on the graph, together with one which represents the unsmoothed DC output after making allowance for the voltage drop across the choke.

During the test measurements were also made of the voltage from each of the LT windings, and on full load they were: 4 volts to the rectifier valve, 4.06 volts from each of the one-amp. windings, and 4.09 volts from the 4/5 amp. winding.

On full load the AC output from each half of the HT secondary was identical and measured 353 volts RMS. There was no audible hum from the transformer.

The regulation is very good, and at the price of 30s. it represents good value for money, considering that it is attractively finished and attention is given to detail, such as fitting rubber bushes in the holes where the leads come out to prevent chafing of the insulation on the wires.

Independent measurements on the Type H2512 choke showed its resistance to be 360 ohms, and its inductance, when passing DC, to be 38.7 henrys with 20 mA., 35.8 with 40 mA, 32.7 with 60 mA, 29.2 with 80 mA, 25.5 with 100 mA, and 20.5 with 120 mA.

The price is 14s.

Listeners' Guide for

THOUGH only portions of the Proms are being given to listeners they occupy quite a large part of the evening programmes. There will be broadcast part of a concert each evening this week. From the Beethoven Concert to-night (Friday) at 8 (Reg.) Percy Manchester will be heard and Solomon will be playing the Pianoforte Concerto No. 2 in B flat.

Wagner's Spring Song and Prize Song will be sung by Parry Jones and the Symphony will be Schubert's "Unfinished" in the concert to be broadcast Regionally at 8.45 on Saturday.

On Monday, Wagner night, the Finale to Scene IV of "The Rhinegold" will be included in the broadcast at 8.35 (Nat.).

From Tuesday's concert will be heard Elgar's Symphony No. 1 in A flat at 8.40 in the National programme. Four Bach compositions are included in the broadcast portion of Wednesday's concert at 8.25 (Nat.). These include the Brandenburg Concerto No. 2 in F for flute, oboe, trumpet, violin and strings and the Concerto No. 2 in C for two pianos and strings. During the second part of this concert, to be broadcast at 9.50 (Reg.), Marcel Dupré will play Handel's Organ Concerto No. 10 in D minor.

The B.B.C. Women's Chorus and Marcelle Meyer, solo pianist, will be heard during Thursday's Debussy-Ravel Prom at 8 (Reg.).

VANCOUVER from the air, showing a stretch of the waterfront. The unveiling of the statue to Captain George Vancouver will be relayed at 10 (Nat.) on Thursday.

THE EDWARD-NELSON REPERTORY PLAYERS, with Betty Nelson, the leading lady, and Donald B. Edwards, who plays the men's leads, in the middle. The Company will, on Sunday at 9 (Reg.), be heard in "The Man from Toronto."

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OLYMPIC GAMES FINALE

Two relays from the Gruenau Regatta Course, Berlin, are to be given to-night (Friday) Nationally. Running commentaries will be included of the final of the Coxswainless Fours at 5.25, and an hour later the final of the Eights.

For a quarter of an hour on Sunday from 6.20 (Nat.) will be given a commentary on the closing ceremony of the Olympic Games. A fanfare of trumpets precedes an address by Count de Vaillet-Latour, and then follows the hauling down of the Olympic flag to the salute of a battery of guns and the ceremonial extinguishing of the Olympic Fire.

SPORT AT HOME

FROM 2.45 until 5.15 on Saturday running commentaries will be given from the scenes of three different sporting events. The microphone will be switched from one place to another, thereby giving listeners the latest and most exciting news available. From the Oval Howard Marshall will comment upon the first day's play in the Third Test match between England and All-India. Commentaries on the second, third and, if necessary, the fourth day's play will also be given at 12, 1.25, 3 and 4.25 in the National programme on Monday, Tuesday, and Wednesday.

Harold Abrahams will be at the White City and will give commentaries on some of the athletic events during the afternoon when the Empire and the U.S.A. meet. This meeting will include stars who have competed at the Olympic Games.

One of the most important events in the bowling world is the Single-handed Bowls Championship. The semi-finals and final will at intervals be described from the Temple Bowling Club ground at Denmark Hill.

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VANCOUVER

IT is fitting on the occasion of the Golden Jubilee of Vancouver that the explorer, Captain George Vancouver, after whom the city and adjacent island are named, should be further honoured, for his voyage in 1792 was one of inestimable importance in the development of Canada.

The unveiling of a memorial to Captain Vancouver by the Rt. Hon. the Lord Mayor of London, Sir Percy Vincent, will be broadcast, Nationally, at 10 on Thursday.

He will be accompanied by the Lady Mayoress and will be attended by the Sheriffs of London.

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PARALLELS

THE fifth edition of "New Songs for Old," a popular series of programmes which have appeared at intervals during the past six years will be compered by Cyril Nash in the Regional programme at 8 on Monday and again at 7 on Wednesday (Nat. and Reg.). The idea behind this series is to link together songs of the Victorian era with their modern equivalents and some astonishingly close parallels can be found.

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HISTORY REPEATS ITSELF

THE story of the Athenian expedition to capture Sicily for its empire is a very exciting one, and Felix Felton has written a dramatic story for broadcasting of the expedition's disastrous failure.

Though connected with history as far back as 415 B.C. "Sicilian Expedition," to be broadcast at 10 on Saturday, Nationally, should prove very interesting. One of the chief interests of the programme, apart from the exciting story, will be the noticeable fact of so many parallels existing to-day.

the Week

Outstanding Broadcasts at Home and Abroad

LOTTE LEHMANN, who plays the chief part in "Fidelio" from the Salzburg Festival, to be relayed by Paris PTT at 7 on Sunday.

JANE AUSTEN BURLESQUE

AT the age of seventeen the inimitable Jane Austen produced, for the amusement of her family, a highly entertaining burlesque of the sentimental novel of the period, and called it "Love and Freindship." If her spelling appears to have been somewhat individualistic at this stage of her development the burlesque itself is a truly remarkable effort for a girl still in the schoolroom. Mary Allen, B.B.C. Drama producer, has turned the burlesque into a short microphone play which should appeal not only to the large army of Janeites, but to everybody with a taste for high-spirited farce. This will be broadcast at 9 on Monday (Reg.) and again at 8 (Nat.) the following evening.

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OPERA

DURING this week three opera relays come from the Salzburg Festival. The first, to-night, at 8.25 when Warsaw relays Wagner's "Mastersingers" which like "Falstaff" figures four times in this year's Festival and will on each occasion be conducted by Toscanini.

All German stations on Saturday are giving Weber's "Oberon" from 8.10 to 10. On Sunday Beethoven's one and only venture in the field of opera, namely "Fidelio" comes from the Salzburg Festival, relayed by Paris PTT and the French Regionals at 7. Although this was never a popular opera we all know of the Leonora Overtures, of which Beethoven composed no fewer than four for this opera.

Monday's principal broadcast approximating to opera is Verdi's "Requiem" from Vichy, which will be given by Bordeaux and probably other French Regionals at 8.45. Verdi is well in evidence again on Thursday, for at 7.5 Vienna, Radio-Paris, and Kalundborg are taking his "Falstaff" from the Salzburg Festival with Mariano Stabile in the title part. At 8.15 Bordeaux, Eiffel Tower, and some of the French Regional stations are taking his "Masked Ball" from the Grand Casino, Vichy.

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GERMAN VARIETY

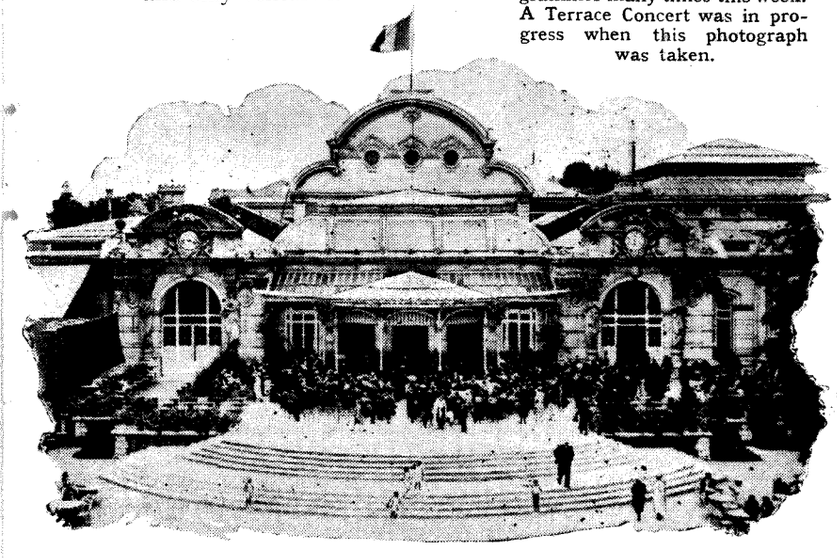
WHAT is described as a great variety evening compèred by Willi Schaffers entitled "Happy-Go-Lucky Ether Wave Stations" comes from Berlin at 8.10 on Tuesday, lasting until 10. Other German stations at 8.10 are giving a programme entitled "Fishing in the Ether" including dance bands and a Schrammeln Quartet, which consists of two violins, harmonica and guitar, so called after the originator, Hans Schrammel of Vienna.

◈ ◈ ◈

ENGLISH TALK

A TALK in English entitled "Pictures in Words" will be given by Colonel Mary B. Booth of the Salvation Army from Copenhagen-Kalundborg on Monday at 6.30.

THE GRAND CASINO, VICHY, which comes into the programmes many times this week. A Terrace Concert was in progress when this photograph was taken.



ENGLISH FOLK SONGS

THE Norwegian broadcasting authorities have invited a party of British schoolboys, on holiday in Norway, to give a half-hour's programme of English folk songs and carols from the Oslo station at 7.30 on Saturday.

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A NOVELTY

ALL German stations, except Berlin, will be radiating at 8.10 on Monday what might well be called a "beery" programme under the heading "Hops and Malt, May God Preserve It."

◈ ◈ ◈

SUNDAY FARE

IN response to repeated requests from Swedish listeners the Swedish network will in future present lighter fare on Sunday evenings. The first sign of this is the one hour programme, "August Night," to be given this week at 10.

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DANCE BAND CAVALCADE

FROM the Danish stations on Saturday evening will be given another Radio Ball. After gramophone records of dance music will follow at 7.30 a programme of syncopated romance. Then come four dance bands in succession playing from 8.45 until 2 a.m. on Sunday. THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, AUGUST 14th.

Nat., 5.25 and 6.25, Olympic Games Relay. ¶"The Bunch of Roses." 9.20, Flute Recital: Edith Penville.

Reg., 8, Beethoven Prom. ¶"Campfire on the Karroo." 10.30, Billy Gerhardi and his Band.

Abroad.

Warsaw, 8.25, "The Mastersingers."

SATURDAY, AUGUST 15th.

Nat., Hughie Green and some of his Gang. 8, Pianoforte Recital: Elsa Karen. 8.40, Variety. 10, "Sicilian Expedition."

Reg., Eddie Carroll and his Music. 8.45, Promenade Concert. 10.30, Henry Hall's Hour.

Abroad.

Deutschlandsender, 8.30, Gala Olympic Concert from the Dietrich Eckart Open-air Theatre.

SUNDAY, AUGUST 16th.

Nat., 6.20, Closing ceremony from Olympic Stadium. 7.55, Scottish service from Iona Abbey. ¶Megan Thomas and Sinclair Logan in songs by Graham Peel.

Reg., 5.30, Rawicz and Landauer ¶Recital: Betty Bannerman (mezzo-soprano) and Pouishnoff. 9, "The Man from Toronto."

Abroad.

Vienna, 8, Beethoven's Ninth Symphony from the Gewandhaus, Leipzig.

MONDAY, AUGUST 17th.

Nat., 6.30, The Bentley Colliery Silver Band. 8.35, Wagner Prom. ¶Pianoforte Recital: Harold Craxton.

Monday, August 17th (*continued*).

Reg., 8, "New Songs for Old"—V. 9, Jane Austen's "Love and Freindship."

Abroad.

Bordeaux, 8.45, "Requiem," from the Casino, Vichy.

TUESDAY, AUGUST 18th.

Nat., "The Tune You Heard," original tunes from recent Midland productions. 8, "Love and Freindship." 9, "Woman's Radio Revue," relayed from America.

Reg., "Music from the Movies." 8.40, Promenade Concert. 10.30, Marius B. Winter and his Dance Orchestra.

Abroad.

Strasbourg, 8.30, Symphony Concert from Gérardmer Casino.

WEDNESDAY, AUGUST 19th.

Nat., 7, "New Songs for Old"—V. 8.25, Promenade Concert.

Reg., 8.45, Pithead Stories, No. 5: "The Stableman's Tale." ¶"Northern Music Hall": Variety from Morecambe. 9.50, Promenade Concert, Part II.

Abroad.

All German Stations, except Berlin, 8.50, Dances of the Nations.

THURSDAY, AUGUST 20th.

Nat., 8.15, Shrewsbury Musical and Floral Fête. 9, Variety. 10, Vancouver Relay.

Reg., 8, Debussy-Ravel Prom. 9.35, Scottish Dance Music, The Reel Players.

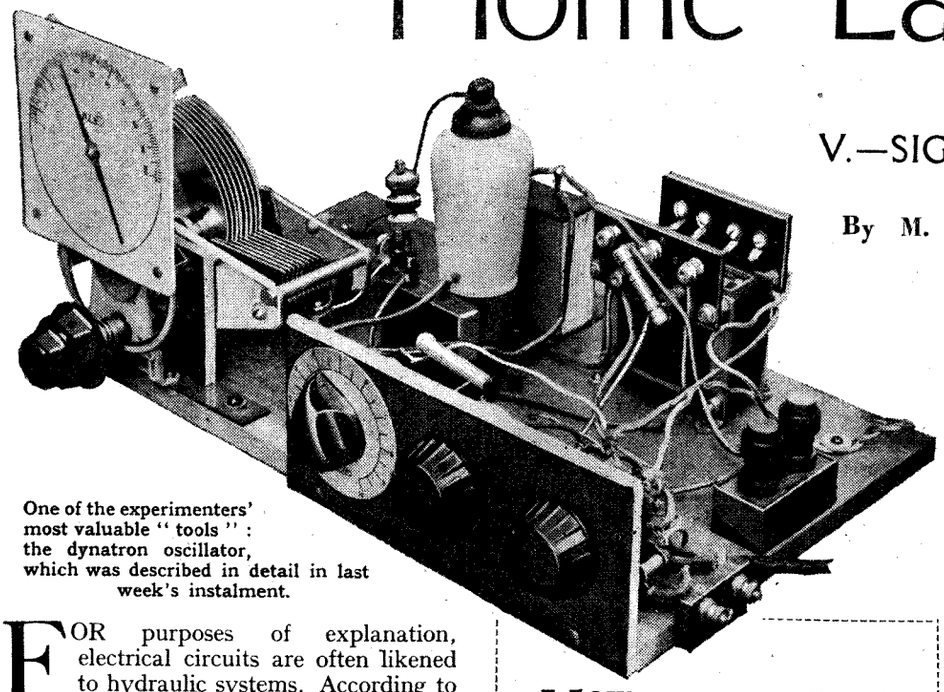
Abroad.

Rome, 8.40, Italian Opera Music from 17th to 19th century.

The Home Laboratory

V.—SIGNAL MEASUREMENTS

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.



One of the experimenters' most valuable "tools": the dynatron oscillator, which was described in detail in last week's instalment.

HOW to put into effect the main object—or at any rate the most fascinating object—for which the home laboratory is usually planned. In this, the concluding instalment, methods of measuring signal voltages (or power) at different stages of the receiver are outlined.

FOR purposes of explanation, electrical circuits are often likened to hydraulic systems. According to this analogy, last week's article in this series dealt with tests on the pipes and other fittings. In this final article we come to the equipment for testing the flow of the fluid itself. For want of a better term the word "signal" has to be used, but I always feel rather apologetic in doing so, because it seems so lamentably inappropriate. Nothing in the dictionary associates the word with the fluctuation of electric current or pressure corresponding to broadcast performances or other items which it is desired to transmit or amplify. The world-famous prima-donna would have reason to feel insulted if reference were made to her "signals" from the Queen's Hall. But as there is no word in the language to take its place, "signal" is used here in the sense just defined.

Broadly speaking, there are three special features about signals that make measurement of them rather more difficult or complicated than non-signal measurements, for which the ordinary volt and current meters usually serve. In the first place the power is generally quite small, and may be very small indeed—far less than that necessary to push a pointer over a scale. Then, secondly, unless the signal is an artificial one such as a tuning note or a test oscillation it is continually fluctuating in amount. And, lastly, an enormous range of frequency is involved.

Clearly the least difficulty occurs at the *output* end of a receiver, where the frequency is relatively low—at most 10 kc/s—and the power may be quite large. The metal-rectifier type of voltmeter commonly used for general AC testing may be successfully applied here. As it is *power* that is chiefly of interest at this stage, it is usual for the output meter to be calibrated direct in milliwatts.

At earlier stages in the audio-frequency amplifier the power is very small, because Class "A" amplifiers are worked by voltage alone, the current being negligible. So to avoid drawing power from the signal itself it is necessary to use a valve voltmeter. This instrument, if properly designed, is workable at almost any frequency, and thus has a limited field of application in the radio stages also. The limitation is sensitivity; it is difficult to get any reading at all below 0.1 volt. As this is much greater than the usual signal level at the input of a receiver, and it is excessively difficult to make an amplifier that can be relied upon to provide a known gain at all frequencies, the usual method of measurement is to compare the signal with a calibrated source—a standard signal generator, in fact.

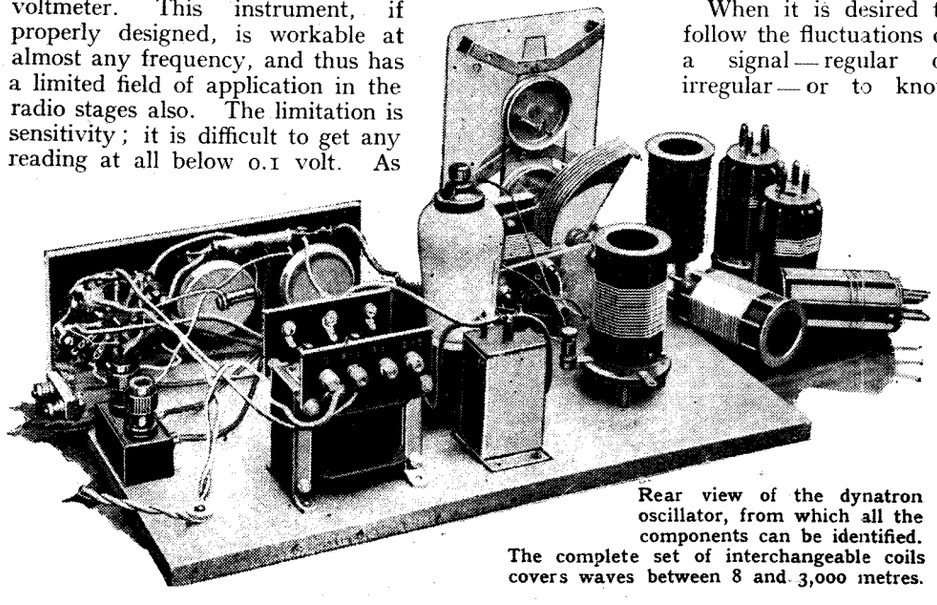
The principle is this: an amplifier with sufficient gain to work an output meter or any other indicator is used, and there is no need to know the actual amount of amplification or even the output; all that the indicator has to do is to show when the known signal is equal in strength to the unknown.

Measuring Overall Gain

Because valve voltmeters are usually not too accurate when used to measure signals of widely different level, this comparison scheme is often adopted even when the signal is strong enough to give a direct reading. It obviates having to depend on the voltmeter calibration at all. For instance, if one wants to know the total gain given by an amplifier, the obvious method, namely measuring the input and corresponding output voltages, necessitates a very wide range of measurement. But by putting a variable attenuator in series with the amplifier the input and output can be made equal—the actual quantity being of only indirect interest—and the amplifier gain is read off from the attenuator.

When it is desired to follow the fluctuations of a signal—regular or irregular—or to know more about it than merely its quantity the proper instrument to use is the cathode ray oscillograph.

There are plenty of other pieces of apparatus designed for signal measurement, but those mentioned—output meter, valve



Rear view of the dynatron oscillator, from which all the components can be identified. The complete set of interchangeable coils covers waves between 8 and 3,000 metres.

The Home Laboratory—

voltmeter, attenuator and cathode ray tube—will probably be enough for even the ambitious home experimenter to consider for a start.

A valve voltmeter can be used for output measurements, but it is certainly not the most convenient instrument for the purpose. The metal rectifier voltmeter that is probably at hand for ordinary AC tests is much more practical. The output power can be calculated from the voltage, if the load resistance is known. (Milliwatts $= \frac{(\text{Volts})^2}{\text{Thousands of Ohms}}$), and in doing so account must, of course, be taken of the resistance of the meter itself. A proper output meter is provided with means for adjusting the load resistance to suit the power valve, and is calibrated direct in milliwatts. If it consisted merely of a voltmeter across a variable resistance the milliwatt scale would have to be different for every value of resistance, which would be impracticable if a really useful selection of resistances were provided. The difficulty is avoided by providing an output transformer with a fixed secondary winding across which the voltmeter and additional load resistance are connected; the primary is tapped, or a number of separate windings provided, so that the fixed load resistance can be made equivalent to any one of a number of different resistances, looked at from the primary side. Under these conditions a transformer which gives nearly perfect characteristics at all frequencies from (say) 30 to 10,000 is a pretty difficult thing to design; but for the purposes for which an output meter is used a very high standard of accuracy under all conditions is hardly necessary.

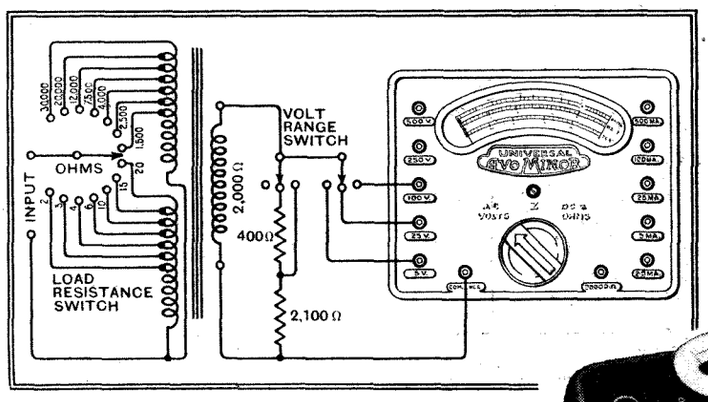


Fig. 2.—Circuit of unit for adding to multi-range test set to convert it into an output meter.

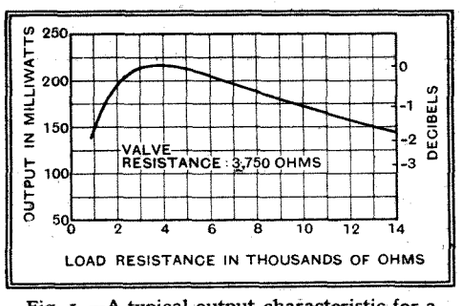


Fig. 1.—A typical output characteristic for a triode valve, showing that the maximum is obtained when the load equals the valve resistance. In practice a greater load resistance is used to minimise distortion, and the loss of output is small.

As an output meter of the type described is quite an expensive instrument it may be of interest if I supply information on how to adapt a rectifier-type AC voltmeter. A voltmeter that is popular with experimenters and service engineers for general testing, and that also happens to be very suitable as the indicating part of an output meter, is the Universal Avominor. Messrs. Sound Sales have produced a special transformer giving seven low-resistance input windings and seven of high resistance. This selection is enough to enable output characteristics to be plotted, such as the sample given here as Fig 1. The average loss due to the transformer is 1db., increasing somewhat above 6,000 c/s. The secondary winding is designed for the resistance of the Avominor at its lowest range—2,000 ohms. On the other ranges the resistance is higher, so extra shunt resistors are needed to maintain the load constant, as shown in the circuit diagram of the unit (Fig. 2). The meter reads as low as 0.1 milliwatt; and, as 5,000 milliwatts is about as high as is needed in most work, only the first three ranges of the Avominor are utilised. It should be noted that on the 5-volt range the resistance of the meter rises much above 2,000 ohms at small deflections, so tests in which this matters should be run at not less than 5 mW.

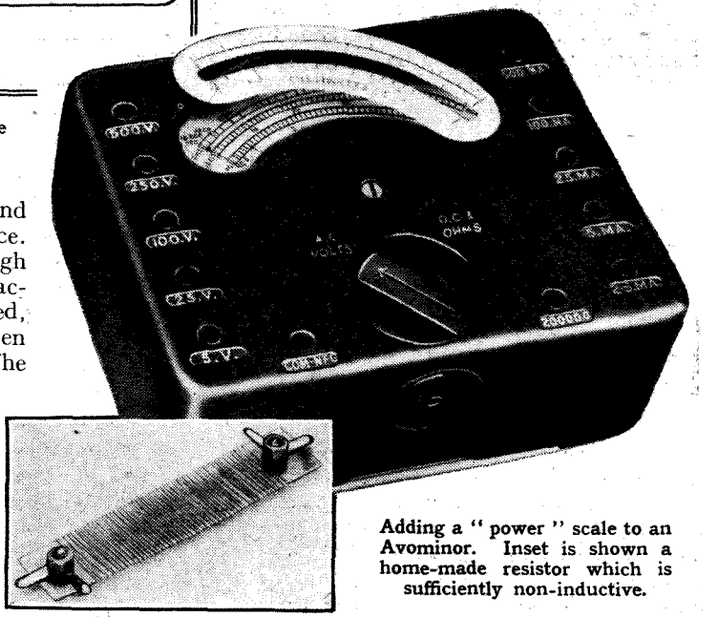
Non-inductive Resistances

The transformer, resistors and range switches can be built into a compact unit in any form that suits the experimenter; it is not necessary for me to do more than suggest this. The resistors call for some comment, though. They should be non-inductive, and the composition sort is good enough if selected and checked for correct resistance within a few per cent. The 2,100-ohm one has to dissipate up to 5 watts, so it may be necessary to use several of lower rating connected in series or parallel. With a bit of luck, half a dozen 400-ohm 1-watt resistors might do for both. An alternative is to wind them of Eureka wire on thin flat slips of mica; 60 yards of 40 gauge for the 2,100 ohms and 12 yards for the 400 ohms leaves enough to spare for final adjustment.

To provide a direct-reading milliwatt scale without opening up the instrument a good idea is to get a piece of stiff Bristol board from an artists' dealer and cut it into a shape to fit snugly over the glass without sliding about. Cut a curved slot in the middle to reveal the position of the pointer over the whole length of the scale, and mark the milliwatt scales above and below. Fig. 3 is useful for deriving the milliwatt scales from the volt scales.

Anybody who feels entitled to refer to his workroom as a laboratory ought not to need reminding to set the switch at a high range for preliminary adjustments.

A rather useful tip that may not be so well known is that when the meter is connected in parallel with the loud speaker, either because there is no convenient means of cutting the latter out or in order to listen to what is going on, the equivalent of the normal standard test output of 50 milliwatts is approximately 15 milliwatts when the output valve is a pentode and about 22 with a triode. This assumes that the impedance of the output meter has been made equal to that of the speaker. Not only is there a division of power between meter and speaker, but the



Adding a " power " scale to an Avominor. Inset is shown a home-made resistor which is sufficiently non-inductive.

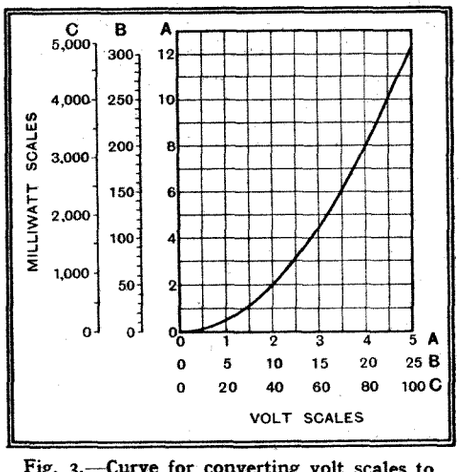


Fig. 3.—Curve for converting volt scales to milliwatt scales, based on a load resistance of 2,000 ohms.

The Home Laboratory—

total power available for both falls owing to the lowering of load impedance, and this loss is the more noticeable in the case of the pentode.

The uses of the output meter for lining up a receiver and for signal generator and audio oscillator tests are obvious. It can also be used for rough comparative measurements of the maximum output of a receiver by turning up the volume until distortion is only just beginning to be noticeable, and then switching over from speaker to meter (adjusted, of course, to the same impedance) and noting the peak readings. To get some idea of the impedance of a loud speaker (or other load), switch the meter in parallel, and the maximum meter reading is usually obtained when the two are approximately equal.

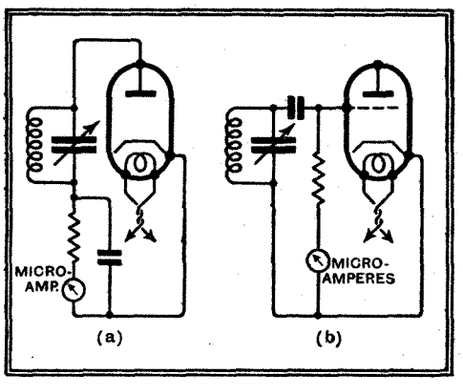


Fig. 4.—Showing positions for connecting a microammeter to utilise the existing (a) diode or (b) grid detector circuits of a receiver to measure the peak radio-frequency voltage.

The test of which Fig. 1 is an example does not necessarily show the correct load impedance for a valve; it shows the impedance that gives the maximum output, but in the interests of quality a somewhat higher impedance is adopted for a triode.

Coming now to the valve voltmeter, I do not propose to say so much about it, because there is a considerable amount of information already available. In essence the valve voltmeter is simply a detector or rectifier valve with a meter in the anode circuit to indicate the strength of the signal. In practice the thing may be very elaborate. It is usual to provide some means of balancing out the steady anode current so that a sensitive meter may be used. Then there is sometimes a more or less complicated range-changing system. Personally, I think that unless one goes in for valve voltmeters rather thoroughly it is just as well to make no attempt to use them as actual scale-reading instruments, but merely for indicating when a signal reaches a certain level. It is certainly very useful to have one that gives voltage readings, but by suitably arranging the method of test it is very often possible to dispense with them.

The "grid" type is the most sensitive, but has fallen into disfavour because (*a*) there is a large anode current to balance out, (*b*) the input loss is relatively high, and (*c*) it does not give RMS values independently of waveform. The "anode bend" or negatively biased grid type is better in all these respects. "Automatic" grid bias, derived from the anode current voltage drop across a resistor connected to cathode is sometimes adopted to extend the range of readings.

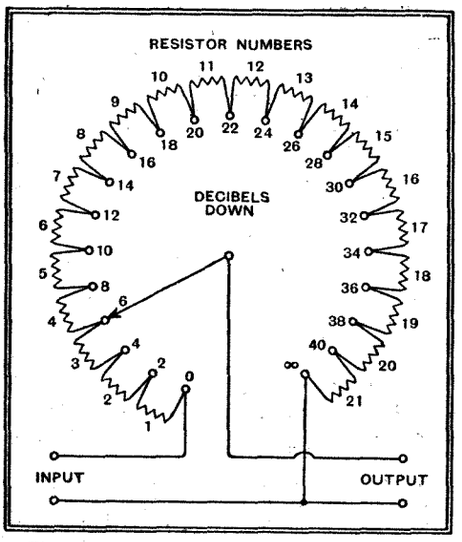


Fig. 5.—Diagram of a 40-db. potential divider for audio-frequency signal measurement. The values of resistances are given in the Table.

When a low-reading microammeter is available there is a very useful method of measuring or comparing HF voltages by introducing it in series with the "grid leak" of a diode or grid-type detector forming part of the apparatus under test (Fig. 4). The *peak* HF voltage, provided that it is not less than a volt or so, is approximately equal to the microammeter reading multiplied by the leak resistance in megohms. The merit of this scheme, in addition to its simplicity, is that the measuring instrument itself introduces no disturbing effect into the circuit.

Calibrating Valve Voltmeters

As regards the orthodox valve voltmeter, some circuits and data for simple and useful types were given in the issue of February 21st last, page 179, which also described methods of calibration. Among them was one employing a simply made potentiometer, switched in 7 steps of 2 decibels each. For measurements on amplifiers, coupling components, filters, etc., on the compensating attenuator principle already described, a greater range of adjustment is desirable, and the accompanying table gives the data for a 40 db. potential divider, adjustable in steps of 2 db. (Fig. 5). Smaller quantities of finer wire may be used, but it should be noted that the very small gauges of Eureka cannot be depended upon to agree closely with the resistance calculated from wire tables. If closer readings than the nearest 2 db. are required they can be estimated, or valve voltmeter calibration over a small range may be used. The total resistance is 10,000 ohms, as that is high enough to be connected across the output of an oscillator or amplifier, or even gramophone pick-up, and is low enough not to cause the amateur serious difficulty in winding.

The resistors are sufficiently non-inductive for audio-frequencies up to 10,000 c/s. if they are wound straightforwardly on thin cards of mica. The proper method when the purest resistance is required is to wind each card with a second section in the opposite direction on top of the first, but as each section must obviously be of double the required resistance (because they are in parallel) the total winding is four times as great as with the simple method and demands considerable care and patience.

Resistor No.	Resistance: Ohms.	Approximate Length of Eureka Wire.
		yds. ins.
1	2,060	55 18
2	1,627	44 0
3	1,300	35 0
4	1,030	28 0
5	820	22 0
6	650	17 18
7	517	14 0
8	410	11 0
9	326	8 28
10	260	7 0
11	206	5 20
12	163	4 14
13	130	3 18
14	103	2 28
15	82	2 8
16	65	1 27
17	52	1 14
18	41	1 4
19	32	0 31½
20	26	0 25
21	100	2 25
Total	.. 10,000	270 yards (just over 1 oz.)

It is not so vital for the total resistance of the potential divider to be accurately 10,000 ohms as for the relative values of the sections to be right.

Fig. 6 shows a typical circuit for measuring the gain of a stage of amplification. The potential divider must always work into a resistance that is large compared with its own resistance on the output side, which in practice generally

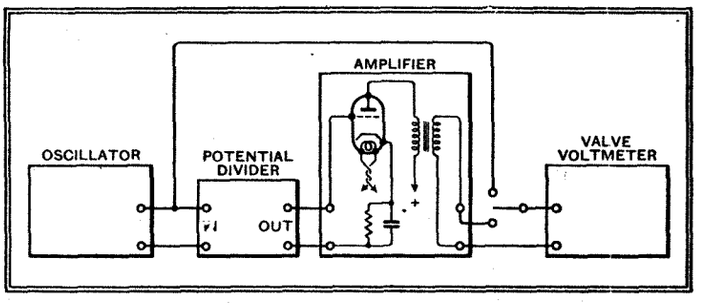


Fig. 6.—Example of use of potential divider.

The Home Laboratory—

means a valve grid. It is adjusted until the valve voltmeter reads the same at either position of the switch. The gain in db. is then read straight off the potential divider. Obviously the signal strength is quite low with this arrangement and may even be interfered with by residual hum voltage; when testing the complete audio section of a receiver it is better to put the potential divider between amplifier and voltmeter, adjusting the input signal to a suitable level by means of an ordinary volume control.

Similar methods are adopted for taking frequency characteristics of amplifiers or components. But a potential divider of this type is not workable at radio frequencies, owing to stray reactances, and for such measurements a calibrated valve voltmeter is valuable. Radio-frequency resistance can be measured by one method (resistance variation) with a ratio of voltmeter readings of 2 to 1 or 6 db., or by another (reactance variation) with $\sqrt{2}$ to 1, or 3 db.; these are well within the capabilities of quite a simple meter, but measurements of stage gain, etc., can hardly be carried out in this way, and a radio-frequency attenuator such as forms an essential part of a standard signal generator is necessary.

This runs into a lot of money, and experimenters who cannot afford a good generator are advised to consider an even more fascinating instrument at a much more moderate price—the cathode-ray tube. The supply unit for a tube can be made up from spare parts at very trifling cost; the ordinary gas-focused tube needs only about 500 volts to give a trace that is distinct enough in any but bright daylight; in fact, 300 volts is enough in a dim light, and the sensitivity is correspondingly greater.

A treatise on the principles, accessories, and uses of the cathode-ray tube is outside the scope of this series, for the space is at an end. But I would again emphasise that the money spent on a tube is not likely to be regretted. There is hardly any branch of laboratory work in which it is not extremely helpful, and many where it is essential.

This series has just scratched the surface of the subject of the home laboratory, but perhaps it may have unearthed some useful suggestions or stimulated some enthusiasm. The home laboratory is the pleasantest and most effective training ground for professional work later as well as a fine recreation for those whose vocations are in quite different directions.

Lastly, I should like to thank those readers who have sent me photographs or other particulars of their own laboratories.

Short-wave Kit for Explorers

AN INTERESTING PORTABLE DESIGN

A PARTY representing the Public Schools Exploring Society is shortly leaving London to explore little-known parts of Finland under the leadership of Surgeon-Commander G. Murray-Levick.

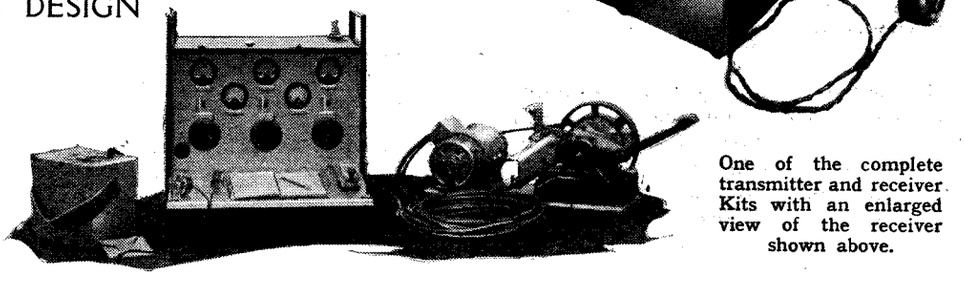
They will keep in touch with the outer world by Pye short-wave apparatus. The entire outfit, consisting of six receivers and two transmitters, was designed, constructed and presented by the Pye Short-Wave Radio Society.

One of the most important considerations in planning this equipment was that it must be light enough to be carried in ruck-sacks and simple enough to be operated by persons whose experience is somewhat limited. The receivers measure 10in. × 9in. × 6in. and weigh 19½ lb. each. They consist of a straight two-valve battery circuit using variable-mu pentode as reacting detector, resistance-capacity coupled to pentode output stage. The wavebands covered are 20-, 40- and 80-metre amateur bands and 600 metres for time-signal purposes. A special coil is also incorporated, covering 8,630 kilocycles, for the purpose of picking up signals from the Admiralty, with whom the Expedition will contact.

Wave-changing is carried out by means of plug-in coils, all of which are contained in the receiver, and are so arranged that they cannot be wrongly inserted. Current is automatically switched on and off when the receivers are opened and closed, thereby preventing wastage. The receiving aerial and headphones are carried separately.

The transmitters, which are designed to operate only on telegraphy, are crystal-controlled and can operate on several frequencies on either the 20-, 40- or 80-metre amateur wavebands. When on 80 metres the 80-metre crystal is used, feeding a neutralised sub-amplifier, which in turn feeds a neutralised power amplifier, and on 40 metres the same crystal can be used with the middle stage acting as a frequency doubler. Alternately, on 40 metres the 40-metre crystal can be used, but on 20 metres the second stage will always act as a frequency doubler. Arrangements are made for switching from one crystal to another when operating on any waveband in order to clear any interference which may be experienced on any particular frequency. All bias potentials are obtained from a battery-driven generator. The generators have been supplied by Mortley Sprague and Company, Limited, to the specifications of the Pye Short-Wave Radio Society, and supply 1,500 volts at 180 milliamps. maximum. The potential is dropped through resistors for the first and second stage supply.

The transmitting aerials have been made to a half-wavelength on 80 metres and are loosely coupled to the power-amplifier anode circuit in order to be safe from DC shock in the event of anyone accidentally touching them.



One of the complete transmitter and receiver Kits with an enlarged view of the receiver shown above.

It is hoped later to establish contact with the amateur station, G5JO, in Cambridge, which is owned and worked by Mr. L. W. Jones, works manager, Pye Radio, Limited, and a member of the Pye Short-Wave Radio Society. Mr. Jones' call sign was used for the testing of the equipment, and, with the kind permission of the Director of Signals at the Admiralty, very complete tests were carried out with the finished transmitters between G5JO and the Admiralty stations, GZZ2 and GYD2.

The work which has been carried out by the Pye Short-Wave Radio Society in connection with this expedition has shown what a very high standard of efficiency and lightness can be reached in portable transmitters and receivers, and it is not difficult to appreciate the value of such equipment in military applications.

CLUB NEWS

The West London Radio Society

A VERY interesting five-metre field day was held recently by the Society. The attendance was very satisfactory, and an enjoyable and instructive day was spent.

Preparations for next winter are already being made. It is hoped to obtain regular headquarters and to install a transmitter. It is also proposed to commence a regular course of lectures for beginners and for advanced members. Intending members are particularly requested to communicate with the secretary as soon as possible, as it is desired to obtain a rough estimate of the likely attendances during the winter. Full details can be obtained from the Hon. Secretary at 22, Camborne Avenue, West Ealing, W.13.

The Leicester Amateur Radio Society

A five-metre field day is to be held by the Leicester Society; the precise date and other details will be announced later. At the annual general meeting held recently a presentation was made to Mr. W. S. Tearle, the Hon. President, on the occasion of his marriage. Mr. Tearle has recently been granted a transmitting licence under the call sign G8CC. The next meeting will be held on August 18th at the Society's headquarters at the Turkey Café, Granby Street, Leicester. Those desiring further information concerning the Society's activities are invited to communicate with Mr. W. Winder, at Lutterworth Road, Leicester.

Transmitter at Warwick School

The Warwick School Radio Society which held an experimental licence in the old "Writtle" days has now been granted full facilities for transmission under the call sign G6PW.

New Apparatus Reviewed

Recent Products of the Manufacturers

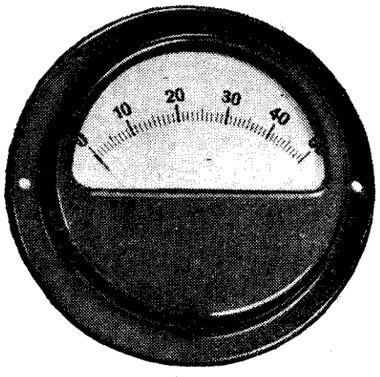
ELECTRADIX MICROAMMETER

A MICROAMMETER is a very sensitive and comparatively delicate measuring instrument, for its function is to indicate a change in current of the order of a millionth part of an ampère. Such meters if accurate and reliable are often quite expensive.

Leslie Dixon and Co., Ltd., 218, Upper Thames Street, London, E.C.4, has, however, introduced a small instrument of this type at the relatively low figure of £2.

It gives a full-scale deflection with 50 microamps of DC, and its accuracy at all parts of the scale is very good. Measurements made with this meter can be accepted as reliable, for compared with a laboratory standard meter its largest error did not exceed 1.5 per cent. Though it embodies a sensitive movement the pointer is well damped and it comes to rest quickly after any change in current.

The scale, which measures about 1½in. long, is clearly marked, and as a thin knife-edge pointer is fitted, changes in current of the order of half a microamp can be determined easily.



Electradix sensitive and inexpensive micro-ammeter.

Instruments of this high sensitivity are usually embodied in valve voltmeters and other delicate measuring apparatus. The Dixon model is very well suited for this use, since it is designed for flush mounting and has the terminals at the back of the case.

NEW POLAR CONDENSERS

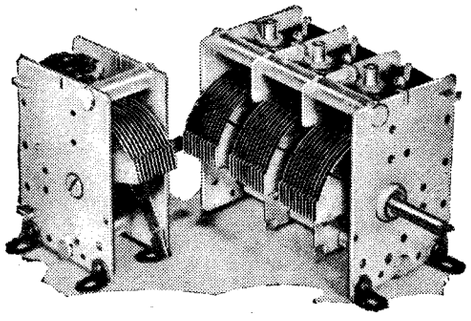
A NEW series of Polar condensers assembled in rigid built-up steel frames and known as the bar-type has been introduced by Wingrove and Rogers, Ltd., 188-189, Strand, London, W.C.2. Single and gang models are made, and an interesting feature of the new design is that the condensers are very compact, a three-gang model, for example, measuring only 4½in. by 2¾in. by 3½in. overall.

Bakelite insulating material is employed in the standard models, but if required the condensers can be obtained with ceramic insulators at a small extra charge.

The aluminium vanes are assembled on a brass spindle which is supported in a ball bearing at the front end with a thrush bearing at the rear. Separate contacts are fitted for each rotor section in the gang models, and the whole is rigidly assembled in the frame, there being no trace of side or end play.

Tests have been made with a single 0.0005 mfd. condenser, also with a three-gang model, in which each section has a nominal capacity of 0.0005 mfd.

The single type, known as the Polar No. 5 condenser, has a minimum capacity of 14.5 m-mfds. and a maximum value of 495 m-mfds., giving an effective change in capacity of 480.5 mfds. It is made in five sizes ranging from 0.0001 mfd. to 0.0005 mfd., and costs 4s. 3d. up to 0.00025 mfd. and 4s. 6d. for the 0.0003 and 0.0005 mfd. sizes. If fitted with ceramic insulation the price is 1s. more in all cases.



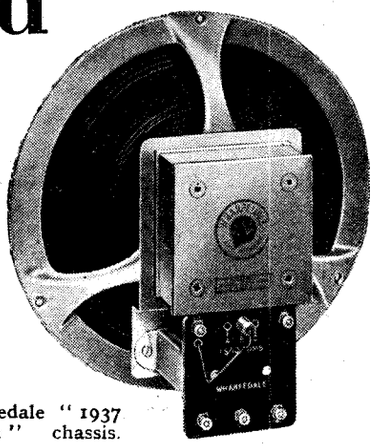
Polar new No. 5 and three-gang bar-construction type condensers.

The three-gang model was first tested for accuracy in matching, for which purpose each section was carefully adjusted to 30 m-mfds. at minimum, and the sections then measured at six different settings of the condenser. The largest percentage difference was recorded at 100 m-mfds., which in the case of our sample was one per cent., or one m-mfd. Elsewhere the difference in capacity did not exceed 0.5 per cent. of the actual capacity. This order of accuracy is perfectly satisfactory for all normal requirements.

The minimum capacity of a section was 18.5 m-mfds., and with the trimmer screwed fully in 83 m-mfds. The maximum value with the trimmer at minimum was 507 m-mfds., giving an effective change in capacity of 488.5 m-mfds.

A two-gang model in this pattern costs 12s. and a three-gang 17s. 6d. With ceramic insulation the prices are increased by 2s. and 2s. 6d. respectively.

They are soundly made condensers and exhibit the fine workmanship, design and finish that characterises all Polar products.



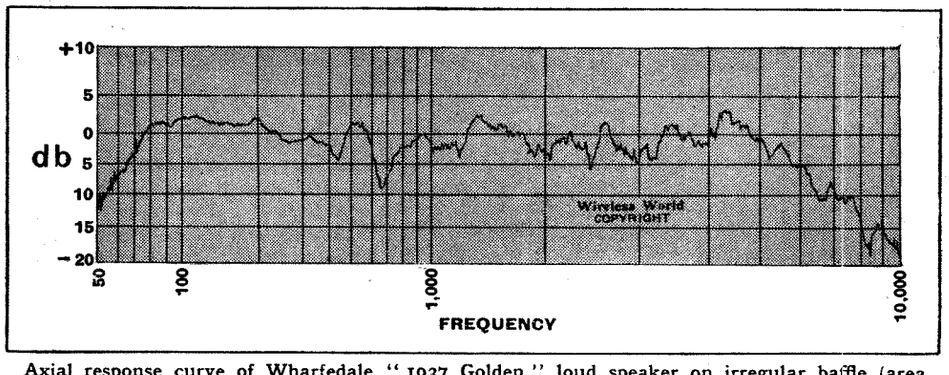
Wharfedale "1937 Golden" chassis.

THE NEW WHARFEDALE "GOLDEN" LOUD SPEAKER

EXTERNALLY the only obvious changes which have been made in the 1937 "Golden" chassis are in the magnet and chassis frame. The former is of appreciably large volume and the latter is now a casting instead of the original sheet-metal pressing.

The diaphragm, too, is of the same type as that used in the previous model, but a glance at the response curve is sufficient to show that important improvements have been effected. The general flatness is remarkable, but this is not necessarily the most important feature. At the top end the output is much better sustained, while in the bass the 80-cycle resonance has disappeared and a clean bass response is maintained up to much higher input levels.

The price of the chassis with universal transformer has been reduced from 62s. 6d. to 55s., and of the chassis without transformer from 50s. to 42s. 6d. The speech coil impedance is 2 ohms, and the unit is one which we can confidently recommend to those seeking an extension loud speaker of more than average quality.



Axial response curve of Wharfedale "1937 Golden" loud speaker on irregular baffle (area approx. 22 sq. ft.). Microphone distance 4ft., power input 1 watt.

POST OFFICE OLYMPIA EXHIBIT

CONTRARY to current rumour, the Post Office will be at the Radio Show again this year. Their location will be in a section of the gallery instead of the entrance floor, as in previous years.

It is understood that "Interference Suppression" will be the principal feature and the exhibit will be arranged jointly with the Electrical Research Association.

RANDOM RADIATIONS

By "DIALLIST"

Television at Last?

THOUGH definite information about the starting of television transmissions in this country is still lacking, the latest report is that demonstrations may be possible at Radiolympia and that the official opening of the London station is likely to be fixed for some time in November. The whole of the television staff, round about one hundred strong, have now moved into the Alexandra Palace, and that looks as if something really might be done, though the exhibition is less than a fortnight away. I predict that there will be demonstrations of a kind, and I only hope they will be such as will let the public see the real possibilities of high definition television to-day.

HT Tappings, Grid Batteries, and Things

IT was no uncommon thing a few years ago to find a battery set provided with a multiplicity of leads besides those which ran to the filament accumulator. HT+1, HT+2, HT+3, HT−, GB+, GB−1, and GB−2 was quite a usual outfit. Though you don't often see such an array as this nowadays, the connecting up of many battery sets is still a bit of a business, and the more connections there are the greater are the opportunities for the uninitiated to go wrong. I am glad to see that one maker, at any rate, has taken the very sound course of eliminating the grid battery altogether, and is providing his sets with just two HT leads. If everyone else would follow suit it might lead to a big improvement in both receiving sets and high-tension batteries.

A Matter of Balance

One trouble with the set that has a separate grid battery and HT tappings at, say, 75 and 120 volts is that the grid battery, being under no load, does not lose its EMF anything like so rapidly as the HTB. Hence, though the grid bias may be perfectly right when the set is first brought into action, it is apt to be a good deal too high when the high-tension battery has been in use for some time. Another disadvantage of the multiple-tapping system is that some parts of the high-tension battery are under considerably heavier loads than others, so that a proper balance of the plate and screen voltages in the set is not maintained. When there are but positive and negative tappings, and grid bias is obtained by the potential drop across resistances, the balance is much better, and it is kept automatically. The making of many tappings adds considerably to the cost of battery manufacture, and, could we come down to but two, makers would be able to devote the money thus saved to improving the quality of ingredients of the cells and of the insulation between them.

The Wavelength Problem

IT has been suggested in various quarters that the B.B.C. may find itself in rather a quandary when it comes to providing wavelengths for the new stations projected or now under construction. I don't think, though, that the position is really very serious. Burghead, which is now getting on towards the testing stage, will, one imagines, supersede the 1-kilowatt Aberdeen, taking over the wavelength of 233.5 metres. In the same way, the North-East England Regional will acquire the wavelength of 267.4 metres from Newcastle, which will become redundant, and the Isle of Wight transmitter may work on 203.5 metres, a wavelength now occupied by Bournemouth and Plymouth.

Possible Complications

Difficulties, however, may arise under the Lucerne Plan since 267.4 metres and 233.5 metres are both shared wavelengths, Newcastle having at present Hungarian and Egyptian partners, whilst Dresden operates on 233.5 metres. If the Lucerne Plan were strictly enforced the output rating of stations using wavelengths of this kind might be limited to something undesirably small; but the output limitations of the Plan seem to have gone largely by the board. One of its provisions, for instance, was that on national common wavelengths no station should be rated at more than 5 kilowatts. Yet on 251 metres, a German National common wavelength shared by six stations, Frankfort operates with 25 kilowatts. The 203.5-metre wavelength is, under the Plan, a British National "common." We are using it in that way at the moment with Bournemouth and Plymouth. There can hardly be any objection if we turn it from a common wavelength into an individual one for the Isle of Wight transmitter.

We Can't Have More

One thing that seems certain is that we cannot hope to be allotted any more wavelengths by the International Broadcasting Union. More than one European country has, in fact, protested against our retaining the present number, claiming that we don't make full use of them since so much simultaneous broadcasting is done from our stations. It is true that for some little time we had really only two main programmes, the Regional and the National, but the movement to make the Regionals more regional should eventually mean that five or six different evening programmes will normally be provided.

It also seems pretty certain that we cannot free another channel by synchronising the Scottish National with the London-North-West group. Synchronisation necessarily means reduction of output power, and the Scottish National needs more rather than less.

A Question of Kilowatts

THE poor reception of British programmes, and particularly of news, from this country in places on the Continent has led to a good deal of discussion in the correspondence columns of the newspapers. Many of our own people who live abroad wrote to say how disappointing it was to be able to receive almost every country but their own, and spoke of the low power of our medium-wave stations in comparison with those of other lands. This provoked a communication from Sir Stephen Tallents, the B.B.C. Director of Public Relations, who stressed the point that doubling a station's output power does not lead to a two-fold increase in its range. That is so, as we all know, but practical experience shows that a 50-kilowatt station is at a severe disadvantage for reception at long range if it has neighbours rated at 100 kilowatts or so on either side. Another consideration is the transmitting aerial. There seems to be no doubt that those of the latest design, besides reducing fading in their service areas, make for good reception at great distances. Northern Ireland, with its 100 kilowatts and an aerial of the latest design, is one of the outstanding instances. Though it is in a group including Breslau (100 kilowatts), the Poste Parisien (60 kilowatts), Bordeaux S.O. (30 kilowatts), Genoa (10 kilowatts), Torun (24 kilowatts), and Hilversum No. 2 (60 kilowatts), all of which are contained in a compass of 14 metres, or 45 kilocycles, it provides first-rate reception in most parts of this country and over a good deal of the Continent as well. In my home it is a strong and steady daylight signal.

We Ought to be Heard

Though very rightly we in this country are strongly in favour of keeping politics and propaganda out of broadcasting there can be no question that it would be much to our advantage for British stations to be able to make themselves heard effectively in European countries where they are now almost unreceivable. Our most favourably situated transmitters for long range towards the south and south-east—where reception of British stations is at its worst—are those at Brookmans Park. One of them, the National, is limited to its present 20 kilowatts by the requirements of synchronised working, but the Regional could give a very good account of itself if it were brought up-to-date and equipped with 100-kilowatt plant. Quite apart from considerations of reception in Europe, the present London Regional does not do too well in many parts of what should be its service area. The rebuilding of the London Regional station is an urgent requirement and it is to be hoped that it will be undertaken at the earliest possible moment.

An Olympic Blunder

BELOW we reproduce two typical letters from "The Daily Telegraph" of August 5th and 6th, in which the conduct of the B.B.C. narrator at the Olympic Games in Berlin is deplored. Further comment on this subject appears on our leader page

August 5th, 1936.

To the Editor of "The Daily Telegraph."

Sir,—As many others of your readers may have done, I listened to the wireless on Saturday afternoon for the opening of the Olympic Games. I am a German, living in London, and as I was with French friends of mine we chose alternatively one of the English and French and German stations, all describing the same ceremony.

There was a remarkable difference between the speakers of each of these three nations. The German had, of course, not to say very much as the speech delivered by Dr. Lewald spoke for itself. When the German speaker described the ceremony he did so in a way fully aware of the historic moment of this meeting of 53 nations.

The Frenchman, on the other hand, had more to explain, but he, too, seemed concerned to give a dignified report.

The most extraordinary way of giving an account was that of the B.B.C. speaker.

When Dr. Lewald solemnly appealed for world-wide understanding and peaceful competition of sportsmen, for comradeship and chivalry—a speech you could understand fairly well over the British stations—the voice of the English speaker was to be heard talking the whole time long, dealing with the most common and superfluous, not to say silly, things.

He told his listeners repeatedly that "this Dr. Lewald was still going on," and that the public was already "bored stiff." He described the greatest living composer of Germany, Richard Strauss, as a man "looking rather old." Later on he talked about such things as the shorts of the runner who brought the torch from Greece.

He described the olive branch as just a green stick, carried by the old Greek who won the Marathon run in 1896, and whom they had "brought out" (!) again for this occasion. Yes, "it must be a great afternoon for this old man," the B.B.C. man said.

The speaker's talkative ignorance was so overwhelming that one could not be cross with him. But, at the same time, may I frankly add that his tactless remarks were in such a contrast to this occasion of a peaceful world meeting that it is only to be regretted that just the English nation, the mother country of our modern sports, did not get an adequate account.—Yours truly,

F. W. PICK, Ph.D.

Esmond-court, W.8, Aug. 3.

August 6th, 1936.

Sir,—Dr. F. W. Pick's letter on Saturday's Olympic broadcast expresses what must have been the feelings of countless English men and women as they listened to that incredible exhibition.

Why, to begin with, send a representative whose knowledge of German was confessedly so slight that he "could not understand" Dr. Lewald's speech of welcome and summarise it for his English hearers? Why, granting this disability, gabble throughout the speech, so that the proportion of listeners who might have understood its drift were debarred from any chance of doing so?

Why ascribe boredom to an audience of official guests at an international ceremony, when such comment would be considered outrageous on a purely domestic occasion—say, a Royal Academy banquet or Lord Mayor's dinner?

Why base the time-table of the broadcast on the extraordinary assumption that the speech of welcome to delegates of 53 nations "would probably last about a minute"?

Why, having made this childish miscalculation on a matter as to which precise information could easily have been obtained in advance, chatter pointlessly on—to crown all with the missing of the actual opening of the Games by Herr Hitler, all of whose words, save the last two, were drowned by the comments on the passing Hindenburg?

Gazing skywards, the commentator was apparently unaware, until too late, that a change had taken place in the speakers, the latter of whom most listeners would have been specially anxious to hear, even if only for a sentence.—Yours sincerely,

G. M. STEVENSON-REECE.

Oxford & Cambridge University Club, S.W.1, Aug. 5.

DISTANT RECEPTION NOTES

THE big station at Villa Acuna, in the Mexican province of Coahuli, which has the call-sign XERA, has been out of action for a long while now. It should be at work again by the time that these notes are in print, but I can't tell you just what the output is, for the information that has reached me says no more than that the power has been considerably increased. The station has been logged in this country before now, and with its greater power it may provide good reception for D. Xers during the coming months.

Turning to the Argentine, I was going to write "Another South American station," when it occurred to me that it wouldn't quite do, since geographically Mexico is in Central America. Long-distance men, however, usually think of stations in Canada and the United States as North Americans, and those in the rest of the continent as South Americans.

Anyhow, Radio El Mundo, the Argentine's biggest station, situated in Buenos Aires, announces that its power is going up very shortly to 75 kilowatts. As its present rating is 65, the increase doesn't sound very startling; in fact, it can have so small an effect upon its reception in its own country that one would hardly think the expense was worth while. However, there it is. Radio El Mundo uses the call-sign LR1 and operates on 1,070 kilocycles, or 256.3 metres. Buenos Aires has two other stations under construction at the moment. These are LRA of 15 kilowatts, which is to work on 750 kilocycles, or 399.8 metres, and LS7, power not yet announced, which is to be allotted the 1,310, or 228.9-metre wavelength.

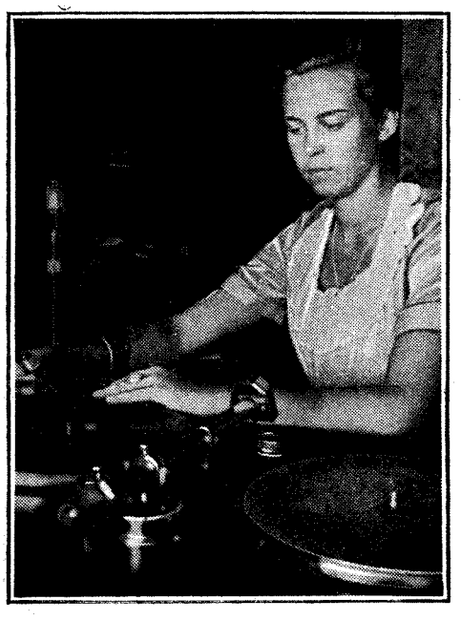
To those who go in for Transatlantic listening the South Americans are very valuable, since it is a curious fact that they usually come in well on nights when North Americans are poor. It is just as well that this is so, for otherwise hopeless jamming would occur between the two sets of stations at long range. Here is an up-to-date list of Argentine stations rated at 5 kilowatts or more:—

LS8.	Buenos Aires ...	1,230 kc/s.	243.8 metres	15 kW.
LS2.	Buenos Aires ...	1,190 kc/s.	252 metres	30 kW.
LR1.	Buenos Aires ...	1,070 kc/s.	256.3 metres	65 kW.
LR4.	Buenos Aires ...	990 kc/s.	302.8 metres	16 kW.
LR3.	Buenos Aires ...	950 kc/s.	315.6 metres	30 kW.
LR2.	Buenos Aires ...	910 kc/s.	329.6 metres	10 kW.
LR6.	Buenos Aires ...	870 kc/s.	344.6 metres	25 kW.
LR5.	Buenos Aires ...	830 kc/s.	361.2 metres	30 kW.
LR10.	Buenos Aires ...	790 kc/s.	379.5 metres	10 kW.
LT1.	Rosario	780 kc/s.	384.4 metres	5 kW.
LS1.	Buenos Aires ...	710 kc/s.	422.3 metres	5 kW.
LS4.	Buenos Aires ...	670 kc/s.	447.5 metres	7 kW.
LS3.	Buenos Aires ...	630 kc/s.	475.9 metres	5 kW.
LS10.	Buenos Aires ...	590 kc/s.	508.2 metres	6 kW.

You may be surprised that the Argentine high- and medium-powered stations should, with one exception, be situated in Buenos Aires. But don't think that this means just the town of this name. Buenos Aires is a province about the size of our own country, and it contains the bulk of the population. There are actually a score of stations of smaller power in the other provinces of the Argentine.

Another point that may strike you about the list given above is that the wavelength equivalents of the frequencies don't correspond exactly to those in use in European lists of stations. You will notice, for example, that LR3, whose frequency is 950, is shown with a wavelength of 315.6, though if you refer to European lists you will find that Breslau works on 950 kilocycles with a wavelength equivelent of 315.8 metres. The frequency figures are exact whether the lists are compiled in Europe or in America, but whereas we take the speed of light and of radio waves as 300,000,000 metres a second in round figures, the Americans use a lower and more accurate, though far less round, figure. The differences are so small as to be almost negligible with a set calibrated in metres; hence, I hardly thought it worth while to undertake the labour of dividing 300,000,000 by over a dozen sets of frequency figures. And, in any case, the average DX-man thinks in kilocycles rather than in metres.

D. EXER.



More and more continental broadcasting organisations are favouring the female linguist. Miss Ida Lebas, who can be heard from the Tallinn (Estonia) station, speaks English, German, French and Russian.

NEW BOOKS

Modern Radio Servicing. By Alfred A. Ghirardi. 1,302 pages—X. Third impression. Published by Radio and Technical Publishing Co., 45, Astor Place, New York City, U.S.A. Price $4. A companion volume, **Radio Field Service Data**, is available at $1.50.

Problems in Radio Engineering. By E. T. A. Rapson, A.C.G.I., D.I.C., A.M.I.E.E., A.I.R.E., F.P.S., pp. 103. Published by Sir Isaac Pitman & Sons, Ltd., Kingsway, London, W.C.2, price 3s. 6d. This useful book, which is one of the Technical School series, greatly simplifies the study of radio engineering. It contains problems drawn from past examination papers of the Institution of Electrical Engineers, the City and Guilds Institute, and the University of London.

Radio Amateur Call Book. Published by Radio Amateur Call Book, Inc., 608, South Dearborn Street, Chicago, Ill., U.S.A. The summer edition of this extremely useful quarterly has just made its appearance. It contains the call signs and the full addresses of practically every amateur transmitting station in the world. It also contains a list of commercial stations working on short wavelengths, and many other useful features. Copies may be obtained from F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Essex, the price being 6s. post free.

BROADCAST BREVITIES

NEWS FROM PORTLAND PLACE

Equipment at Radiolympia

AS in past years, the B.B.C. will be responsible for the apparatus at Radiolympia which supplies programmes of music and speech to exhibitors for demonstration purposes. A considerable amount of equipment is required, and it is all designed and installed by the B.B.C.

Visitors May Look

Apart from the apparatus in connection with the theatre, which is located on and adjacent to the stage, and consists, in the main, of a somewhat elaborate "Outside Broadcast" equipment, the apparatus to serve the stands, etc., is situated on the first floor of the Grand Hall, and, although it will not be on general view, arrangements may be possible for those specially interested to view it on application to the B.B.C. engineers on duty.

Studio Furnishings

To a large extent the programme matter is derived from gramophone records, which are reproduced from a studio in Olympia. Public announcements are also given out to visitors throughout the day by the same channel. In the studio is a desk containing two gramophone units and a microphone unit with a three-way switch for connecting any of these to the amplifier chain as desired. The actual switching is effected by remote control relays in the power amplifier room. These relays connect the studio output to a three-stage amplifier consisting of two high-gain triodes followed by a power triode, all indirectly heated. A potentiometer is included at the grid of the second stage, this being the only volume control in the chain. The amplifier is in duplicate, in case of a breakdown.

Four Hundred Watt Amplifier

The power amplifier has been designed to give an undistorted output of 400 watts. The input from the three-stage amplifier is applied via a push-pull transformer to the grids of the first stage. The valves used here are triodes, having an anode dissipation of 30 watts each and grid bias of 120 volts. These are resistance-capacity coupled to the output stage, which is arranged as two separate push-pull pairs, each with its own output transformer. Each of the output triodes has an anode dissipation of 700 watts, and the total undistorted output obtainable from the four is 400 watts approximately. Meters are distributed in all anode circuits and a level-indicating meter connected in series with that on the control desk is fitted on the instrument panel.

Five Hundredweight of Apparatus

Power supply equipment is housed in a separate unit of the same dimensions as the amplifier unit. A transformer supplies AC at 18 volts for the output stage filaments, but the filament supply to the first stage is DC, obtained from metal rectifiers, and is adequately smoothed, as it is important to keep the hum in this stage at a very low level. HT supply is obtained from a pair of half-wave mercury-vapour rectifiers arranged as a full-wave rectifier capable of supplying one ampere at 3,000 volts.

When the main switch on the front of the unit is closed, the AC mains are connected to the transformers supplying the filaments of both stages, the grid-bias rectifier, and the transformer for heating the filaments of the mercury-vapour rectifiers. The smoothing provided for the HT supply consists of two condensers, one of 6 mfd. and one of 8 mfd., and a 9-henry choke. This unit includes a certain amount of heavy apparatus. The complete power supply unit weighs about five hundredweight.

Ultra-Shorts from Broadcasting House

PASSING a door on the sixth floor of Broadcasting House, attention would certainly be attracted by a notice, "Danger—High Voltage." Through a circular peep-hole would be seen an array of transmitter valves, their filaments gleaming white hot. It is the ultra-short-wave transmitter room.

B.H.-B.P. Link

Transmissions on wavelengths in the region of 6 and 7 metres are going on fairly regularly from the aerial slung to a mast at the south end of Broadcasting House. There have been persistent rumours, despite B.B.C. denials, that the B.B.C. is using (or has used on occasions) an ultra-short-wave link between Broadcasting House and Brookmans Park, and that this accounts for the exceptionally high quality on the London National wavelength. The B.B.C.'s reply is that the high fidelity is due to an exceptionally good landline to Brookmans Park. They admit that the ultra-short-wave transmissions *have* been received at Brookmans Park, but only on a mobile transmitter van which paid a visit there during its general perambulations, and they assert that the purpose of the transmissions is purely experimental.

Nevertheless, in the event of a total landline breakdown—such a thing as might occur in a "national emergency"—a radio link between Broadcasting House and the transmitters outside London would be invaluable.

MR. O. B. HANSON, Chief Engineer of the N.B.C. since 1926, holding the top-hat ultra-short-wave transmitter which he designed for commentators. This was described in *The Wireless World* of May 1st last.

Television Make-up

THE appointment of Miss Mary Allan as "make-up" assistant in television is of considerable technical interest, for the task of securing a correct balance of light and shade at the television transmitter is tantamount to that of balancing musical instruments in a sound broadcast.

A face by any other name may sound as sweet at the microphone; but place it before the television scanner and we shall all know the worst—unless Miss Allan is present.

Television Cannot Lie

Miss Allan intends to shatter the prevalent illusion that television cannot lie. Already she has accumulated a vast experience in make-up for the films and the stage—an experience which goes back to the special make-up courses instituted by Oscar Asche when "Chu Chin Chow" was staged.

In the matter of television, of course, there are few precedents to act upon, but Miss Allan will be present at the special competitive tests by rival make-up manufacturers at Alexandra Palace during the next few days.

Closed Circuit Colour Tests

The "victims" in this case will be the three announcers—Jasmine Bligh, Elizabeth Cowell and Leslie Mitchell—all of whom will have to lend their faces to the competing experts for hours at a stretch. Results will be watched by an examining committee *via* television over a closed circuit. The firm producing the best results will win the powder and paint contract for the next few months.

A Chief Engineer Arrives

MR. O. B. HANSON, who is in some degree the "Sir Noel Ashbridge" of U.S.A., is now on a visit to this country. As Chief Engineer of the American National Broadcasting Company, Mr. Hanson is combining business with pleasure, his intention being to study broadcast engineering technique in Britain, Germany and Holland.

Mr. Hanson Combs Britain

Beginning his British investigations in Scotland, Mr. Hanson is working southward and will probably reach the B.B.C. headquarters before these lines are in print. If, as seems more than likely, Mr. Hanson visits Alexandra Palace, he may smile wryly at the similarity between the television situation in his country and ours. True, America has actually started high-definition transmission, but political as well as technical difficulties are once more proving that the path of true television never did run smooth.

Recent Inventions

The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

CATHODE-RAY TUBES

IT is desirable that the spot of light provided on the fluorescent screen by the electron stream should be as small in area and as high in light intensity as possible. Usually this has been secured by the use of a high anode-voltage and by means of focusing electrodes, which increase the velocity of the stream but tend to damage the screen by the resulting violence of impact.

According to the invention the desired result is secured with a low-velocity stream by replacing the standard type of cathode by a short solid rod of highly-emissive substance. The rod is arranged along the axis of the cathode-ray tube. It is heated by applying a voltage between it and an adjacent electrode sufficient to produce a continuous discharge across the intervening gas-filled space.

F. J. G. van den Bosch. Application date July 10th, 1935. No. 445820.

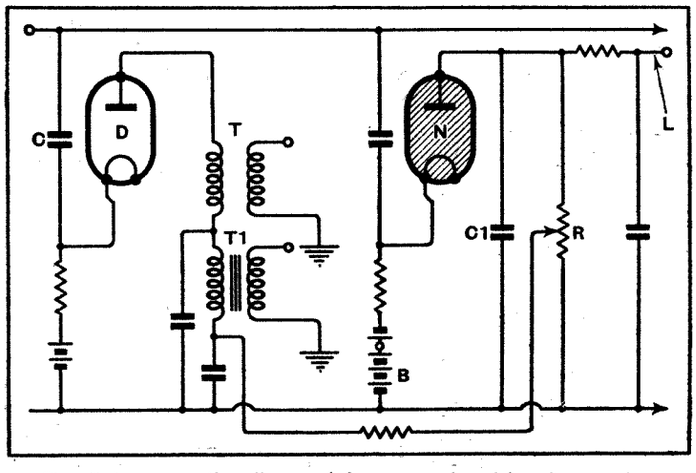
o o o o

TELEVISION

THE figure shows a circuit for separating-out the line and frame synchronising frequencies from the received picture signals and for regulating the amplification of a television receiver. The mixture of signals is applied through a condenser C to a diode D. The output circuit of the diode feeds two transformers T, T1 tuned to the short "line" impulses and the long "framing" impulses respectively.

The amplification is automatically regulated by a gas-filled discharge tube N, which is biased just below the threshold point by a battery B. The tube passes a sufficiently large current, even during the shorter of the two synchronising impulses, to charge a condenser C1 up to the negative peak value of the signal. Until this occurs the lead L to the amplifier is earthed over the resistance R, and the grid bias on the amplifiers sets them at maximum sensitivity.

Radio Akt. D. S. Loewe. Convention date (Germany) October 11th, 1933. No. 445428.



Circuit for separating line and frame synchronising frequencies.

DIRECTION-FINDING

ONE of the difficulties in taking accurate bearings with a frame aerial lies in the fact that on a weak signal the position of minimum signal strength is "broader" than that given by a strong signal, thus introducing a larger factor of error; similarly, if the signal fades severely the operator may be deceived into thinking that the point at which it fades completely is the critical angle of zero pick-up.

In order to avoid both errors the signals are received on two different aerials simultaneously. One is a frame aerial for taking the required bearings, whilst the other is an aerial of a different type, or of the same type differently set. The signals picked up on the second aerial are then used to regulate the "gain" and so sharpen the directional response of the first aerial.

M. Sandfort (assignor to H. N. Wolff. No. 2026254 *(U.S.A.).*

o o o o

FREQUENCY MODULATION

TWO valves, normally tuned to produce slightly different frequencies, are cross-coupled together so that they are "entrained to produce a single frequency, which is the mean of the two normal frequencies." A microphone current is then applied so as to vary the internal impedance of the two valves, and therefore the frequency of the radiated carrier-wave, at signal frequency.

M. G. Crosby (assignor to Radio Corporation of America). No. 2032403 *(U.S.A.).*

RADIO LANDING SYSTEM

THE pilot of an aeroplane, as he approaches the aerodrome in fog or conditions of poor visibility, transmits a warning signal. This is received and analysed on the aerodrome by two or more direction-finding aerials which are constantly trained on the moving craft so as to follow its track. The resulting angular movements of the DF aerials are transmitted by follow-up gearing to a central station, and are there co-ordinated with a map of the landing ground which shows all obstacles likely to be dangerous to the pilot as he descends to earth.

In this way there is built up at the central station a stationary picture of the landing ground, on which a moving "point" is superposed to show the track of the craft in the air. This picture is then transmitted by television to the aeroplane, so that the pilot sees on his dashboard a picture of the aerodrome, together with an illuminated "point" which indicates his own path as he brings his machine to ground.

J. H. Hammond, Jr. No. 2027527. *(U.S.A.).*

o o o o

ADJUSTABLE CATHODE-RAY ELECTRODES

ONE of the electrodes of a cathode-ray tube is mounted so that it can be moved relatively to the others, from outside the tube, in order to allow the electron stream to be focused at a desired spot on the viewing screen. The support carrying the "movable" electrode passes through an open-ended tube, which is sealed into the glass stub and passes beyond it into a cup containing mercury. The base of the cup is screw-threaded to allow the electrode to be moved bodily along the major axis of the cathode-ray tube.

F. J. G. van den Bosch. Application date July 10th, 1935. No. 445507.

o o o o

TELEVISION SYSTEMS

IT is an advantage in television to alter the direction of the scanning lines periodically, because in the first place it tends to reduce flicker. Also the pattern traced by the scanning-spot (the so-called "scan structure") is less apparent in the reproduced picture if the direction of the scanning-lines is alternated. Finally, when the length of the scanning aperture is small compared with its breadth, the detail of the picture is improved by traversing the picture in both directions.

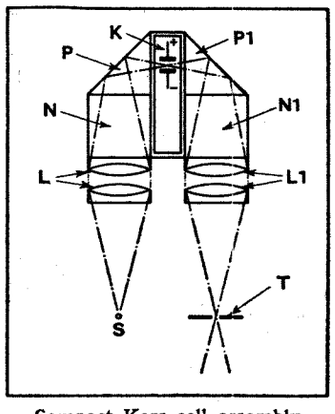
The object of the invention is to provide a simplified system for scanning a picture first horizontally and then vertically, and superposing both images alternately on the same viewing-screen. This is effected by using a system of lenses to project two images of the same picture simultaneously in two positions, which are separated in space and located at right-angles to each other. One image is then scanned vertically in combination with its own photo-electric cell. That cell is then switched out of action, and a second cell is brought into circuit to receive the light from the second image, which is scanned horizontally. The two operations are repeated in rapid succession throughout the whole period of scanning.

Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett, and L. E. Q. Walker. Application date October 19th, 1934. No. 445894.

o o o o

KERR CELLS

IN the ordinary arrangement of light-valve as used in television, the ray of light to be modulated is passed in succession first through condenser lenses and then through the first Nicol prism into the Kerr cell, the emerging ray passing from the cell into the second prism and then through a final lens. These various components are arranged in line with each other, so that they take up some considerable length.



Compact Kerr cell assembly giving greater optical efficiency.

The figure shows a more compact arrangement. The ray from the source S passes via lenses L through the first Nicol N. This is backed by an internally-reflecting prism P which directs the ray into the Kerr cell K. The return path is bent back parallel to the first by a prism P1, the second Nicol N1, and lenses L1 to an apertured screen T. Both reflecting prisms P, P1 are made contiguous with the cell and Nicols, so that the number of air-gaps is decreased and the optical efficiency of the arrangement correspondingly increased.

E. Traub. Application date December 4th, 1934. No. 445498.

o o o o

POWDERED MAGNETIC CORES

A high-permeability core, for tuning-coils and the like, is manufactured at low cost from an alloy of iron, aluminium and silicon containing an admixture of manganese, chromium or vanadium. The alloy is pulverised into fine powder, heated for oxidation, and mixed with an insulator or binder. The powder may be pasted on to sheets of paper or fabric and then rolled into core shape.

K. Z. Kenkyusho. Convention date (Japan) April 21st, 1934. No. 445614.

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Olympia, 1936

Guide to the Show

WEDNESDAY, August 26th, will see the opening of the annual Radio Exhibition at Olympia, and again it will be our endeavour to give our readers as complete a record of the Show as possible in three Special Numbers.

The present issue may be regarded as a guide or forecast, intended to direct readers' attention to what may be expected to prove outstanding features of the Show and to assist them in appreciating what are the general tendencies. We cannot hope to do more in this first special number than cover the ground somewhat superficially, for the reason that the issue is compiled in advance of the opening of the Exhibition and we are, therefore, dependent on early information collected or supplied to us by exhibitors. In some cases it has been found in past years that manufacturers withhold information on certain of their exhibits until the last moment, in order to introduce an element of surprise, and in such cases we are not able to give information in advance.

In our second Show Number, to be dated August 28th, a stand-to-stand report will be compiled and fully illustrated, so as to give a comprehensive idea of the products of every exhibitor.

In our third special Show Number, which will appear on September 4th, the technical staff of *The Wireless World* will, as on previous occasions, record their impressions of the Exhibition and draw attention to technical trends or outstanding features of interest which a critical examination of the Exhibition will have revealed.

The most prominent feature of this year's Show will undoubtedly be the appearance on nearly every stand of receivers incorporating short-wave tuning bands, and it seems probable that receivers of this type will prove extremely popular. There will be no marked price reductions with this year's sets, but, instead, visitors will find that the cheaper receivers have been improved in appearance and, to some extent, in performance, whilst many refinements have been incorporated.

Television Possibilities

Television will certainly attract special attention, and whilst only a comparatively small number of stands will show television receivers, it is probable that television will be sufficiently well represented at the Show to give the public a fair impression of what the new service has to offer when the regular B.B.C. transmissions commence from the Alexandra Palace. It will probably not be made known until a very short while before the Exhibition opens whether or not actual demonstrations of reception of test transmissions from the Alexandra Palace will be possible, so much depends on whether the preliminary tests justify public transmissions of this kind and whether reception conditions at Olympia will permit demonstrations to be carried out without undue interference. Every effort will, we believe, be made to contribute something towards making Olympia a source of information to the public on the question of television possibilities. If demonstrations are conducted they should be under home-reception conditions, so that the public will see just what they can expect in their own homes, no more and no less, and it is to be hoped that the Exhibition authorities will not be driven to accept any compromise.

New Receiver Designs

A PRELIMINARY SURVEY: SEASON 1936/37.

THE OLYMPIA SHOW: AUG. 26th TO SEPT. 5th.

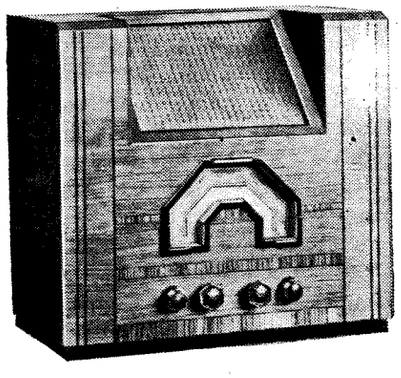
A BALANCED forecast of the activities of the principal manufacturers of broadcast receivers. Although the Show does not open till next Wednesday, sufficient information is now available for "The Wireless World" technical staff to form a useful opinion of general tendencies in design.

OF the receivers on view this year at the Olympia Show, there is no doubt whatever that a large percentage will be of the all-wave type. Nearly every manufacturer will have at least one model in this category, and many will have several. There will be considerable divergences not only in detail but in major circuit factors between the products of different manufacturers, for the same degree of standardisation has not yet been reached in the field of short-wave reception as it has in the older sets covering only the medium and long wavebands.

For easy reference, the various types of receivers—all-wave, mains-driven and battery sets for the normal wavelengths, special-purpose sets—have been classified in sections and are described under appropriate headings. It should be understood that our comments refer mainly to the chassis, and that in many cases these are mounted in different cabinet styles as both table receivers and radio-gramophones.

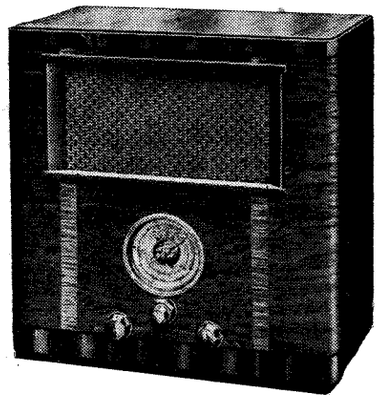
ALL-WAVE RECEIVERS

THE receivers on view will be divisible into two main classes—straight sets and superheterodynes. The former are usually less expensive than the more ambitious superheterodynes, and in this class the information so far to hand reveals that almost invariably three valves are used as an HF amplifier, a detector, and an output pentode. More divergency exists in the case of the superheterodynes, and they range from four valves upward, the valves in the smaller sets usually functioning as frequency-changer, IF amplifier, diode detector and AVC, and pentode output.



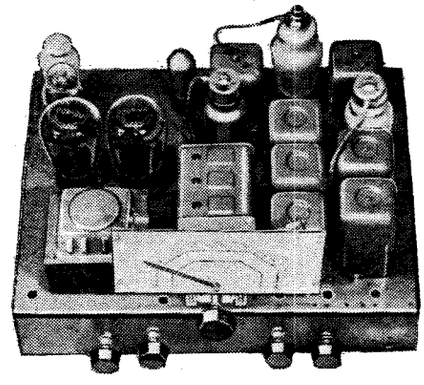
The Aerodyne Model 52 three-valve all-wave receiver

One of the largest receivers will be the H.M.V. Model 801, which has a tuning range with no fewer than five bands and



The Alba type 870 four-valve all-wave superheterodyne.

extending down as far as 7 metres into the television band. The ranges are 7-16, 16.7-53, 46-140, 185-560, and 750-2,200 metres. An HF stage is included, and precedes the triode-hexode frequency-changer; there is one IF stage and the duo-diode-triode, which functions as a detector and provides AVC, is followed by two LF stages employing triodes. The output stage has two PX25 valves delivering 10 watts to the triple speaker assembly. A dual-ratio tuning control is fitted, and the tone control enables the bass and treble response to be independently varied. Somewhat smaller sets with a pentode output valve, but otherwise similar in



Chassis of the Armstrong 4-band superheterodyne.

specification, will be shown, while there will also be a three-band set, covering 16.5-51.5 metres, in addition to the medium and long wavebands. This is the Model 482, and it has a signal-frequency amplifier before the frequency-changer, one IF stage, and a duo-diode-triode feeding an output pentode.

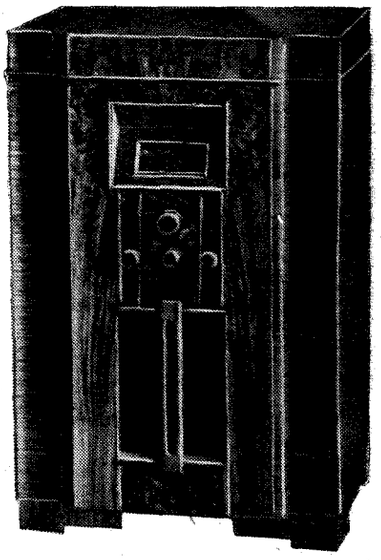
A nine-valve superheterodyne covering the bands of 12.9-35 and 35-100 metres, in addition to the usual broadcast ranges, will be found on the stand of Armstrong Manufacturing Co. HF amplification before the frequency-changer is used in this set, which includes an output stage with two PX25 valves fed through a transformer having a loaded secondary. The chassis is priced at 15 guineas, and a smaller model with PX4 valves is listed at 11 guineas.

One of the C.A.C. models, the Austin "Empire" receiver, also includes two short-wave ranges, the set covering 10-2,000 metres in four bands. A triode-

New Receiver Designs—

hexode frequency-changer is used, and there is one IF stage; the detector is a duo-diode-triode, which also provides AVC and LF amplification and feeds the output pentode. One feature of the receiver is that each of the two IF transformers includes three tuned circuits. It is priced at 16 guineas.

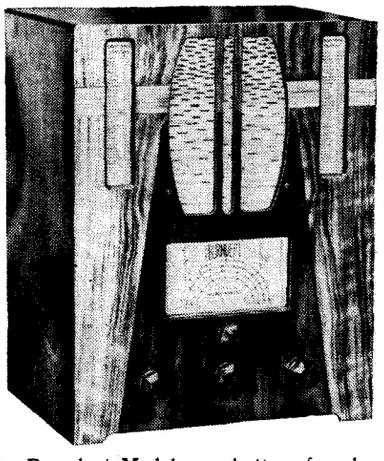
The Ever-Ready Model 5011 covers 13-33, 30-182, 198-550, and 900-2,000 metres, so that it also falls into the four-band class. A dual-ratio tuning control is fitted, and it is priced at 18 guineas. The four ranges of the Portadyne A64, however, cover 16-50 and 50-150 metres, in addition to the medium and long waves;



The Burgoyne T.R.F. All-Wave A.C.4 radiogram.

in this set there is a signal-frequency amplifier and one IF valve.

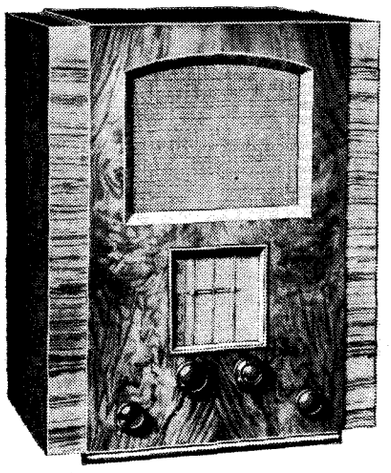
Among the Marconiphone receivers must be mentioned the Model 366. It is a radio-gramophone with an automatic record-changer and a receiver covering 7-140 metres in three ranges in addition to the ordinary broadcast bands. A signal-frequency amplifier is used with a



The Burndept Model 251 battery four-band band-pass receiver.

triode-hexode frequency-changer and one IF stage operating at 460 kc/s; a duo-diode-triode follows and feeds the output pentode.

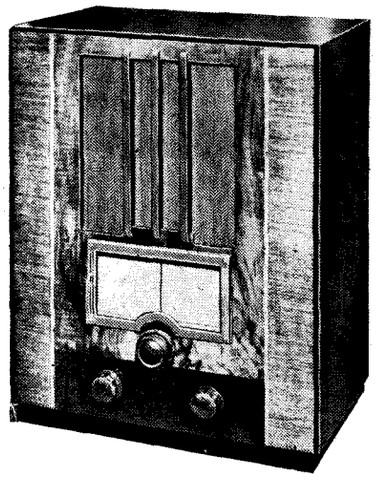
The Invicta AW57 has five bands covering 13-27, 25-75, 75-200, 200-550, and 800-2,000 metres. The intermediate fre-



The Bush Radio S.S.W.37 superheterodyne.

quency is 465 kc/s, and an octode frequency-changer is used with one IF valve, a duo-diode-triode, and an output pentode. It is priced at 14 guineas. The Lissen 8114 covers 13 to 82 metres in two bands as well as the ordinary broadcasting wavelengths. It includes variable selectivity.

In addition to large receivers with resistance-coupled push-pull amplifiers on the LF side and outputs ranging up to 12 watts, R. G. D. will be showing a superheterodyne of moderate size. This is the Model 625 at 25 guineas. It has a 3-watt output stage, and variable selectivity is included in the interests of high-quality

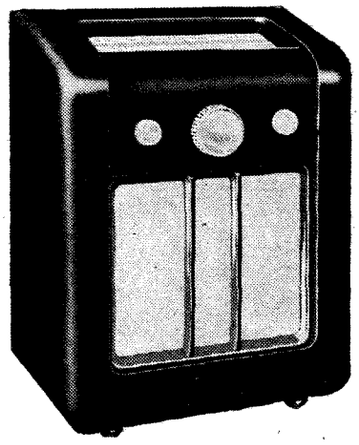


C.A.C. Austin "Empire" all-wave receiver.

reproduction. Nowadays it is a *sine qua non* that AVC be fitted, but not all sets include a signal-frequency amplifier as this does. There are four tuning ranges covering 16-50, 45-150, 200-550, and 850-2,000 metres. A similar receiver to this is the Model 660, which has a $3\frac{1}{2}$-watt triode output stage and a cathode-ray tuning indicator. It is also fitted with a loud speaker covering the wide range of 40 c/s to 8,000 c/s.

A large superheterodyne will be found on the stand of Self-Changing Gramophones. This has a variable-mu screen-grid valve in the HF stage, and the frequency-changer is a triode-hexode. For the two IF stages HF pentode-type valves are used, and the last valve is a duo-diode-triode. The intermediate frequency is 465 kc/s, and, in addition to the medium and long wavebands, the short wavebands of 13-35 and 30-80 metres are included. For use with this receiver an LF amplifier of the resistance-coupled, push-pull type with an output of 15 watts will be shown.

Ultra Electric are also among the firms who will be showing a receiver with more than a single short-wave range. This is the Model 47, which covers 13-35 and 30-80 metres. It has AVC, and is priced at 17 guineas. The cheaper Model 48 all-wave receiver shown by the same firm has only the band of 16.8-50 metres, in addition to the medium and long waves.



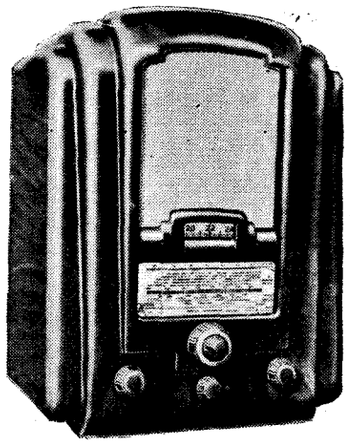
The Ekco AW87 all-wave superheterodyne.

The receivers of this type with one short-wave range will probably be among the majority, and although the wavelength range covered is naturally smaller than in those sets which have two or even three short wavebands, the more important wavelengths are within the range of the set. Even with a single band all the more important of the world's SW stations can be received so far as tuning range alone is concerned.

The Kolster-Brandes receivers are good examples of this category, and the Model 560 covers 19-52 metres, 200-570 metres, and 850-1,950 metres. The triode-hexode frequency-changer is preceded by a band-pass filter on medium and long wavelengths, but a single-tuned circuit is used on the short waveband. The intermediate frequency is 460 kc/s, and there is one IF stage before the duo-diode-triode which not only provides detection and AVC, but also feeds the pentode output valve. A dual-ratio tuning dial is used, and there is a cathode-ray tuning indicator. A special feature is that the input circuit is arranged so that the set can be used with an ordinary aerial, the Rejectostat system or with a dipole aerial. It is priced at 16 guineas.

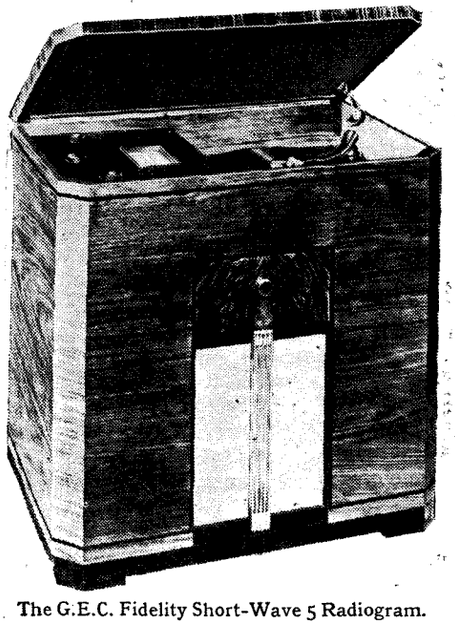
New Receiver Designs—

The Ferranti all-wave sets all include a short-wave range covering 19-51 metres, and one of the more interesting is the "Gloria"; this is similar to the



The Ferranti Nova all-wave receiver for A.C mains.

"Arcadia," but has a push-pull output stage delivering 6½ watts to the loud speaker. It is a radio-gramophone with an automatic record-changer and is priced at 52 guineas. Variable selectivity is fitted, and a special feature is made of the tuning dial, which has an effective scale length of no less than six feet, thus greatly simplifying the calibration of the set on short waves. This scale length is obtained by means of optical magnification. A smaller superheterodyne made by this firm is the "Nova" at 12 guineas;



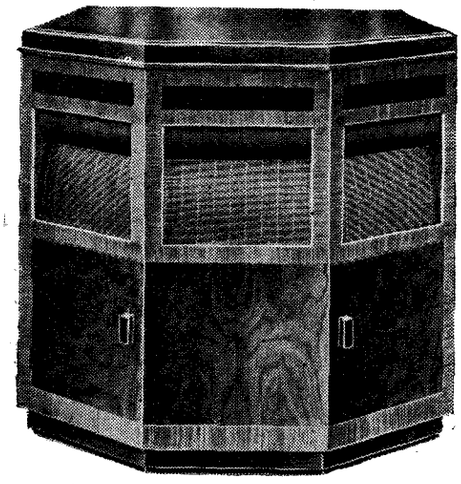
The G.E.C. Fidelity Short-Wave 5 Radiogram.

an AC/DC model is available at 13 guineas, and a battery model at 11½ guineas. In this set a heptode frequency-changer is used with one IF stage and a duo-diode-output pentode.

A screen-grid-type valve is employed in the HF stage of the G.E.C. Fidelity All-Wave Receiver, and is followed by a triode-hexode frequency-changer and two IF stages, for which HF pentodes are used, operating at 445 kc/s. A duo-diode-triode provides detection, AVC and LF amplification, while two pentodes are used to provide the output of 6 watts. A dual-ratio tuning dial is fitted and there is a variable sensitivity control; incidentally, a sensitivity of 3 μV. is claimed on short waves. In addition to the medium and long wavebands, the set covers the range of 16-98 metres; a special overseas model is available without the long waveband, but covering 16-550 metres without a gap. The receiver is priced at 25 guineas.

A smaller receiver which will be shown by this firm has a band-pass input circuit which, on the short waveband of 16-50 metres, is changed to a single tuned circuit. One IF stage is used and the output valve is a pentode. Variable selectivity is included, and the set, which is known as the Fidelity Short-Wave 5, costs 15½ guineas.

The Model SSW33, which will be shown by Bush Radio, has a triode-hexode frequency-changer, one IF valve and a duo-diode-triode feeding the output pentode.

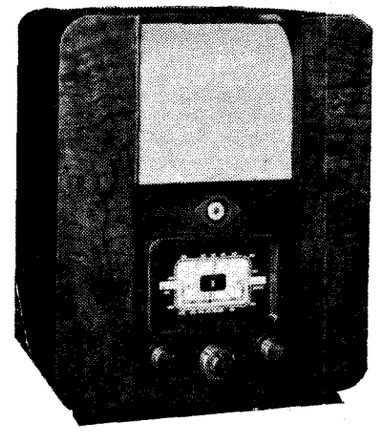


H.M.V. All-Wave "Concert" Autoradiogram Model 801 with three loud speakers.

AVC is included, of course, and a dual-ratio tuning control. The wavelength range is 17-53, 198-550, and 850-2,000 metres, and the set is listed at 11½ guineas. A somewhat larger set at 15 guineas, the SSW37, will also be on view. In this there is a signal-frequency amplifier before the frequency changer, and each of the two IF transformers, which are tuned to 465 kc/s, is fitted with three tuned circuits. A triode output valve is used.

The Ekco all-wave receiver is of the four-valve type with a triode-hexode frequency-changer. There are one IF stage, a duo-diode-triode and an output pentode, and the short-wave range covers 19-50 metres. It is the Model AW87 and costs 12 guineas. The Decca-Brunswick sets cover 16-49 metres on short waves, and the Models BCA/1 and BTA/1 have an HF amplifier, frequency-changer, two IF stages, a duo-diode for detection and AVC, and a pentode output valve. The former model is a console listed at 22 guineas, while the latter is a table model at 18 guineas. This chassis is also fitted to the radio-gramophones, which cost 39 guineas; in this case, however, two pentodes are used in parallel in the output stage.

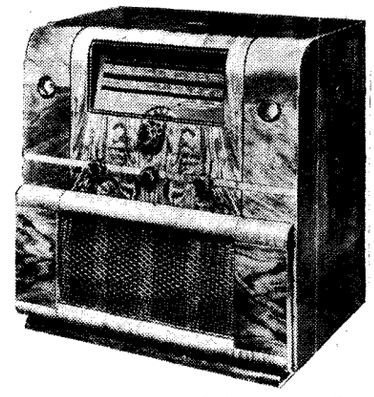
The Alba receivers also fall into this category of sets with one short-wave range. The Model 870 has a triode-hexode frequency-changer, one IF valve, a duo-diode for detection and AVC, and a pentode output valve. Iron-cored coils are used, and the short waveband is from 17 metres to 50 metres. A single tuned signal-frequency circuit is used on the short waveband, but a band-pass filter on the medium and long wavelengths. A



The Kolster-Brandes KB 560 AC mains superheterodyne.

dual-ratio tuning control is fitted, and the set is priced at 11 guineas. A similar receiver, Model 850, but with an octode frequency-changer and two IF stages, will be shown at 14 guineas. AC/DC models will also be on view, as well as a radio-gramophone.

One of the features of both the Mullard and Philips receivers is what one might call "joy-stick tuning," since a single tuning knob performs multitudinous functions in the manner of the joy-stick of an aeroplane. The knob is rotated in the conventional manner for tuning, and two ratios are available; the volume control is operated, however, by sliding the knob in

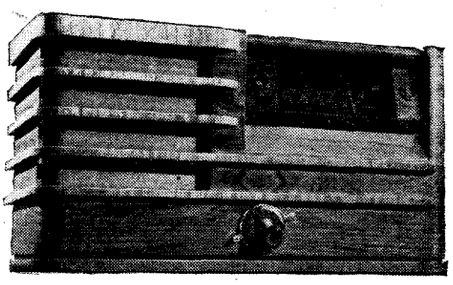


The Marconiphone Model 534 all-wave receiver.

a vertical direction and the tone control by sliding it horizontally. In addition, a sliding collar around the knob operates the wave-change switch.

New Receiver Designs—

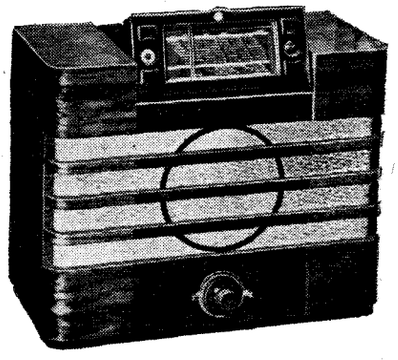
In other respects two of the sets to which this tuning control is fitted, the Mullard MAS5 and the Philips 795A, are



Mullard M.A.S.5 all-wave receiver with multi-purpose control knob.

similar. Both have an octode frequency-changer, one IF stage and a duo-diode-triode feeding an output pentode, and both have a cathode-ray tuning indicator. One feature of outstanding interest from the technical viewpoint is the deliberate use of feed-back in the LF amplifier. This is obtained from the output transformer, and it is claimed that its use not only improves the frequency response characteristic but reduces amplitude distortion. Both sets have an intermediate frequency of 128 kc/s and are fitted with variable selectivity.

Philips have also a battery superheterodyne which is unusual in possessing a two-valve frequency-changer. One IF stage is included with a duo-diode-triode and a QPP output valve.



Philips 795A receiver with adjustable tuning scale for easy vision.

The superheterodyne, however, does not by any means hold the field in all-wave receivers, and there are numerous examples of the straight set. Aerodyne, for instance, will show a battery-operated receiver at 7 guineas, covering 18-50, 200-550 and 800-2,000 metres. It is a three-valve set with an HF stage, a triode detector, and a pentode output valve. The Model 51 is similar but has a tuning range extending down to 16.5 metres, and iron-cored tuning coils are used with a band-pass pre-selector. This set costs 8 guineas and both AC and AC/DC models are available. Ever-Ready also have both battery and AC/DC sets with a similar circuit arrangement. These are the Models 5015 and 5013, and the tuning ranges are 18.5-54, 202-560 and 900-2,000 metres.

The triode seems the favourite detector in the straight sets, and is used in the Lissen 8130, an AC/DC set at 9 guineas, which covers 18-54 metres on short waves. It is also employed in the Invcta CW3B, a three-valve battery set at £7 9s. 6d., covering 17-51 metres, 200-550 metres, and 900-2,000 metres. The Kolster-Brandes KB515 is an AC set of this three-valve type with a triode detector and an HF pentode in the HF amplifier. Two

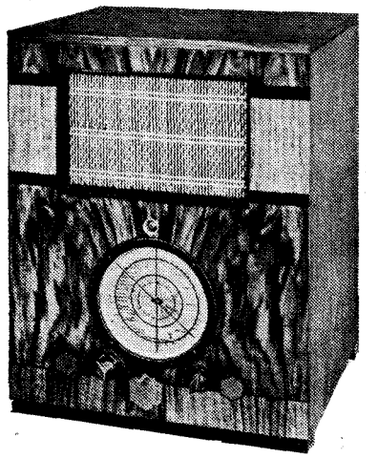


Table model of the R.G.D. 625 all-wave superheterodyne.

tuned circuits are used and the LF valve is resistance-coupled to the detector; the output is 3½ watts, and the short-wave tuning range covers 19-50 metres. AC/DC and battery models are available.

The Burgoyne All-Wave TRF receiver, however, employs an HF pentode as detector, and a sensitivity of 15 μV is claimed. The output is 2½ watts. Both Burndept and Vidor remain faithful to the triode as a detector and differ from usual in providing two short wavebands of 13.5-48.5 and 48-145 metres as well as the normal medium and long wavebands. The Burndept 251 is a battery set, with one HF stage and a pentode output valve fed from the detector by transformer coupling. It costs £7 19s. 6d. The Ferranti Parva is of this three-valve type and is available in AC and AC/DC forms as well as in table, console and radio-gramophone models.

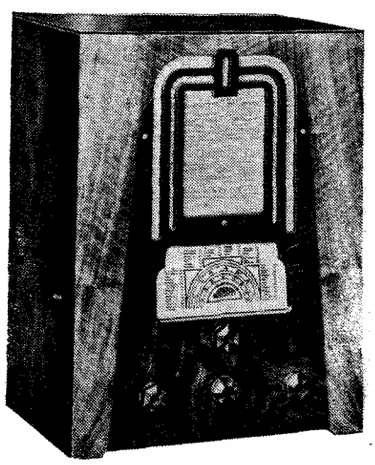
The H.M.V. Model 149 is a battery set with screen-grid valves for both the HF and the detector stages. A pentode is used to provide the output, which is 400 milliwatts, and the total current consumed from the HT battery of 175 volts is 7 mA. The set tunes over 18-50, 195-560 and 785-2,000 metres.

The Cossor All-Wave 3733 is unusual in that it functions as a straight set on the normal broadcast bands, but as a superheterodyne on short-waves. It is a three-valve battery set in which iron-cored coils are used, and is priced at £7 15s.

BROADCAST RECEIVERS: MAINS DRIVEN

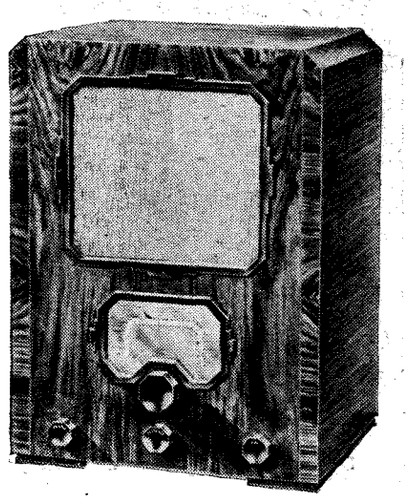
ALTHOUGH the new all-wave receivers rather tend to divert interest from those which cover merely the humdrum broadcast bands, it seems likely that these less spectacular receivers will continue to attract their share of attention.

The so-called "short superhet" remains virtually the standard set, and basically has undergone little change since last season, though there are many detailed modifications and refinements. Both "low level" and "high level" detection are still employed; in spite of the fact that many sets make use of a different type of frequency changer, the H.M.V. Model 425 is a good example of the low-level tech-



Burndept AC superheterodyne.

nique in which the second detector is called upon to give only a small output, due to the presence of an intermediate LF



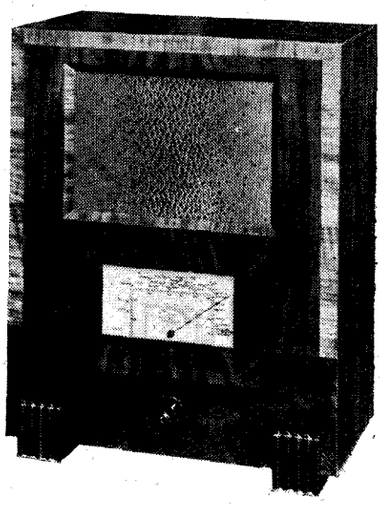
Cossor three-circuit AC/DC "straight" set.

stage. This set includes a heptode frequency changer, a variable-mu IF pentode, a double diode for detection and AVC, and, following the intermediate LF stage, an MPT4 pentode as output valve. Slight variations of this specification are to be found in the H.M.V. Model 380, which is fitted with an elliptical cone speaker.

An example of high-level detection is to be found in the Ultra 101 AC superhet, in

New Receiver Designs—

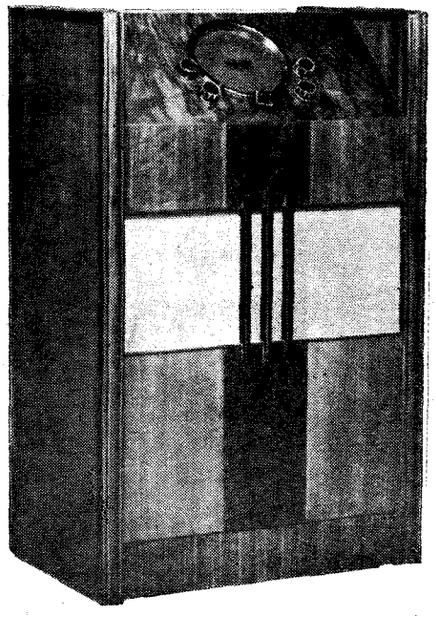
which the output of the detector is fed directly to the control grid of the output pentode. A "universal" Ultra set with



Decca AC superheterodyne.

a similar specification is to be shown, and the same basic circuit arrangement is employed in the radio-gramophone costing 19 guineas, or 25 guineas with an automatic record changer.

Many of the new sets should be more convenient to operate than their predecessors; although most of the more intriguing

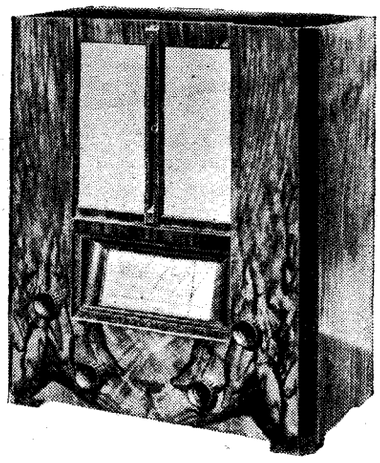


Dynatron Viking : console model.

tuning devices are to be found in the all-wave sets, at least one of the broadcast band models includes a distinct innovation. This is the McMichael 366 radio-gramophone, which employs what may be called a remotely controlled tuning dial of large diameter, which is recessed into the lid covering the motor board. The circuit is a fairly standard superheterodyne 4-valve arrangement, and another convenient fitting is an edge-wise thumb control for volume which protrudes so that it can be operated with the lid closed.

The position with regard to iron-cored coils seems to have undergone no great change. These coils are still mainly confined to straight receivers, although an exception is to be found in the Alba superheterodyne, in which they are employed in both signal-frequency and intermediate-frequency circuits.

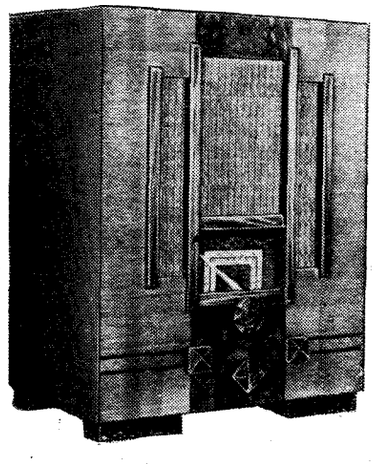
Pentode output valves are still in high favour, but one of the exceptions will be found in the Bush superheterodyne, available either as a table model or in console form, in which an AC044 is employed. The same firm is to show a six-stage seven-circuit superhet with variable selectivity—still a somewhat unusual refinement in the 10-guinea class. Another moderately priced set with variable selectivity is the Kolster Brandes model for either AC or AC/DC, in which Litz-wound coils are used in all circuits. A triode (rated 2.8 watts) is fitted in the Pye T18, a superheterodyne with an up-to-date specification



G.E.C. "AC Super 4."

and several refinements. The cheaper Pye model is fitted with a pentode.

An unusual circuit specification is embodied in the Lissen AC superheterodyne, which employs no IF stage as such, but depends on fixed reaction for amplification. There are three valves in all and "automatic variable selectivity" figures in the specification.

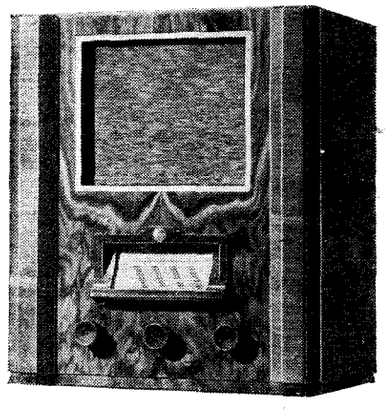


Invicta AC superheterodyne.

So far as can be judged at present, no great novelties are to be expected in the AVC systems of the broadcast sets, whatever may be the case with regard to all-wave models. Several of the latest receivers employ Westectors for AVC purposes, and among these is the Burndept Model 257. Another new set in which special attention has evidently been paid to the control system is the C.A.C. "Coronation" model, in which QAVC with adjustable suppression level is controlled by an extra valve.

Remotely controlled dial of McMichael radio-gramophone.

The keen judge of values who goes to Olympia this year should find it easier than hitherto to assess the relative worth of the sets that are offered. Everybody knows that valve stages and tuned circuits cost money, but it has not always been easy to obtain precise information on these points. However, there now seems to be a welcome tendency to disclose this information freely in published specifications, etc.



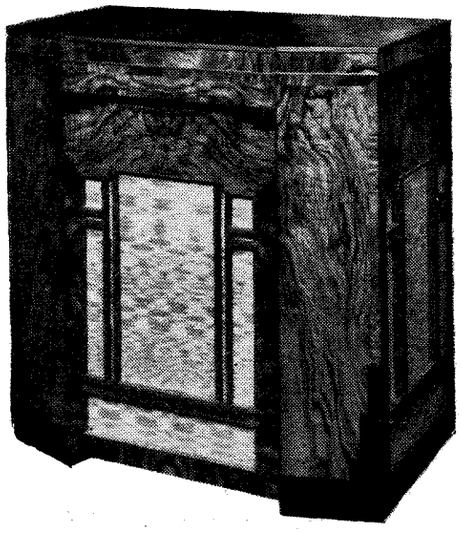
Philips AC/DC Superinductance receiver.

For example, the Decca Model 500 with seven tuned circuits costs 10½ guineas while the cheaper 6-circuit set, Type 400, is priced a guinea lower.

Ekco, who, if we remember rightly, were the pioneers of "stage" ratings, are showing an interesting nine-stage superhet for which a level response from 50-

New Receiver Designs—

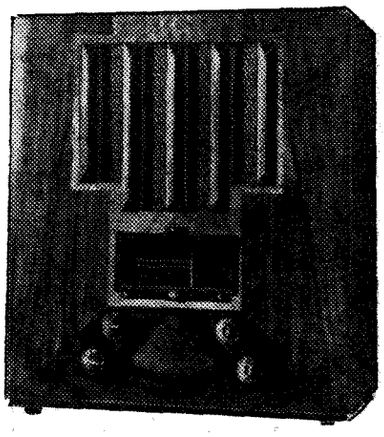
8,000 cycles is claimed, together with complete freedom from second channel interference. The set, which includes variable



Prism radio-gramophone.

selectivity and tone-compensated volume control, costs 12½ guineas. A less ambitious seven-stage set for either AC or DC is being produced.

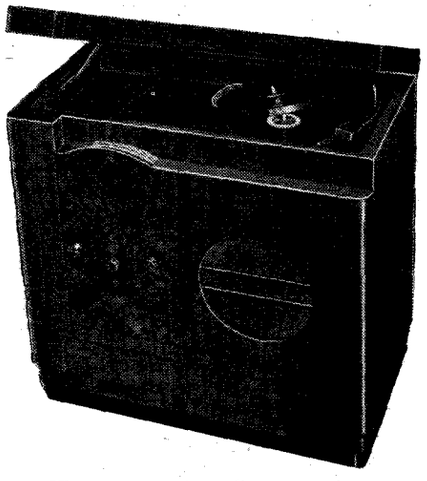
In many cases the sets we have described are obtainable either as table models or as radio-gramophones, the chassis remaining unchanged, but in other instances slight modifications are made for the more ambitious instruments. For example, the Cossor small superhet is modified by fitting a double diode triode in place of the plain diode and thus an intermediate stage of LF amplification is provided. Among other firms showing small superheterodynes are Marconiphone, G.E.C., Ever-Ready, Portadyne, Burgoyne, Vidor, Aerodyne, Cossor, etc.



Pye superheterodyne Model T17

Although the superheterodyne principle is now so widely used, a few designers of high-quality equipment still prefer the straight circuit. Prominent among these is the firm of Hacker & Sons, whose Dynatron receivers all include this arrangement, with iron-cored coils throughout. For the present season the number of valves has been increased in all cases. An interesting, and in some ways typical model, is the Viking, with 2-HF stages and a triode output valve. A similar all-wave set comprises the same chassis with the addition of a short-wave tuner built into the cabinet. Many of the more ambitious receivers are being dealt with in this forecast under other headings, but it is opportune to refer here to the Prism radio-gramophone, giving the large output of 8 watts, and also of the Armstrong 8-valve chassis with phase-reversed push-pull and two large push-pull triodes in the output position. The same firm make a six-valve chassis, also with triode output.

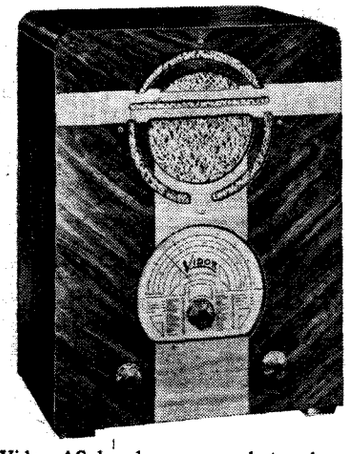
In addition to the all-wave model described elsewhere, the Brunswick BGCA/01 radio-gramophone should be



Ultra automatic radio-gramophone.

mentioned in view of its extremely ambitious circuit, which includes a signal-frequency HF stage and two IF amplifiers, with nine circuits in all. A similar circuit specification is embodied in a table model. Brunswick sets are to be shown on the Decca stand.

Where a low-priced receiver capable of satisfying the less exacting kind of requirements is needed, our old friend the HF-det. LF set is still well capable of meeting



Vidor AC band-pass superheterodyne.

the case, and for the coming season a receiver of this type figures in the programmes of many manufacturers. The G.E.C. model (AC37) includes Litz-wound coils and—a very unusual feature in a one-HF set—a system of AVC of which details are not yet available. The set also embodies pre-set as well as controlled reaction.

The Philips AC/DC 3-valve receiver embodies Superinductance coils, and in view of its high inherent sensitivity is not fitted with reaction.

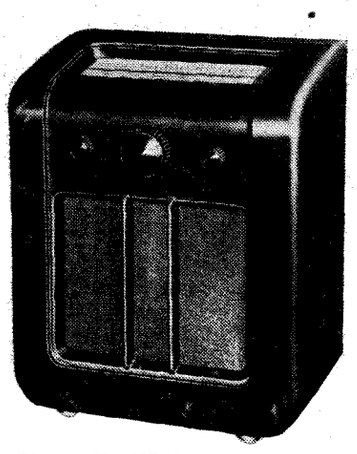
The Cossor version, available either for AC or AC/DC, includes iron-cored coils. The cheaper models are of the two-circuit type, but the advantages of three circuits may be obtained in "triple-tuned" models at slightly extra cost.

BROADCAST RECEIVERS: BATTERY MODELS

UNLESS some unexpected novelty makes its appearance at the last moment, the Ekco "No HT" battery receiver will probably be regarded as the greatest innovation of the season in this particular field. The principle on which it operates—that of the vibratory HT generator—is by no means new, having been used for years in car radio and before that for Service purposes, but it is something of an achievement to design a unit suitable for operating on low voltage in a domestic receiver.

In the Ekco set, the vibratory generator, which is of the self-rectifying type, is operated from a four-volt accumulator which also feeds the filaments of the valves, connected in series-parallel groups. This accumulator, which supplies 1.4 amps., is thus the sole source of supply for the set, which is a seven-stage superhet.

In the G.E.C. straight battery receiver, Model TRF3, the feature of pre-set reaction, in addition to normal reaction controllable by external means, is to be found. Another refinement which is still



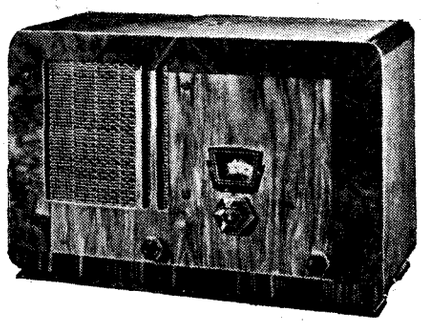
Ekco "No HT" battery receiver.

by no means universal is automatic bias. The G.E.C. is also to show a battery

New Receiver Designs—

superheterodyne fitted with QPP output. The same system of output is employed in the Ultra Model 103 superheterodyne.

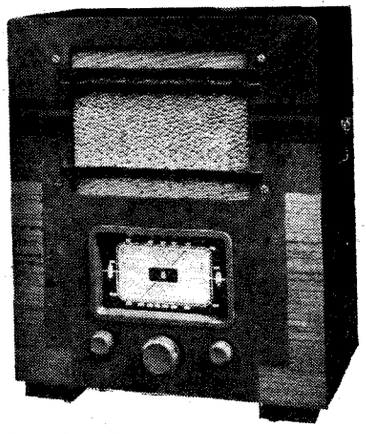
Although it would appear that the modern high-efficiency pentode is gaining ground as compared with battery economy systems, these valves are by no means universal, and all systems are well represented. For instance, the Westinghouse method of controlling output valve bias in sympathy with the signal by means of a metal rectifier is employed in several sets, including the Portadyne model.



H.M.V. "straight" battery set.

In the cheaper Cossor battery sets air-cored coils are employed, but more refined models at slightly higher prices include iron-cored windings with either pentode or Class B output. Class B is also included in the battery superheterodyne made by this firm.

Due to the somewhat lower sensitivity of battery valves, the tendency to fit "signal frequency" stages is rather more marked than in the case of mains models. An example of such a set is the Decca, with a total of seven circuits.

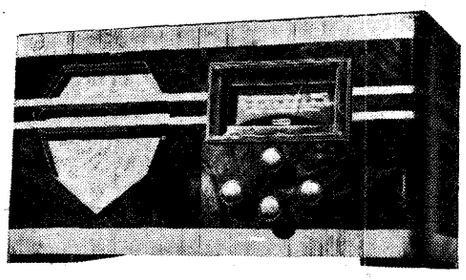


Kolster Brandes battery superheterodyne.

It seems that variable selectivity is not to figure in many of the battery sets, but a few, including Kolster Brandes superheterodyne, include this refinement.

As in the case of mains-operated sets, the purchaser of the new season's battery models will generally get what he pays for in the important matter of tuned circuits. The cheaper straight sets are all of the 2-circuit variety, but a number of those at slightly higher prices are fitted with the extra circuit which certainly makes a big difference in performance. Among these band-pass receivers is the Vidor model, which seems to be very moderately priced at £6 15s., complete. Incidentally, a large proportion of this season's sets are sold without batteries; not a bad thing from the user's point of view, as he can exercise discrimination in the matter of capacity, but the point should be borne in mind when comparing values.

Several of the recent straight sets are fitted with so-called "Droitwich filters" to prevent spreading of the high-power station; among these is the Mullard MB3, which includes Litz-wound coils on low-loss formers, and in the design of which constant sensitivity at all wavelengths has been aimed at.

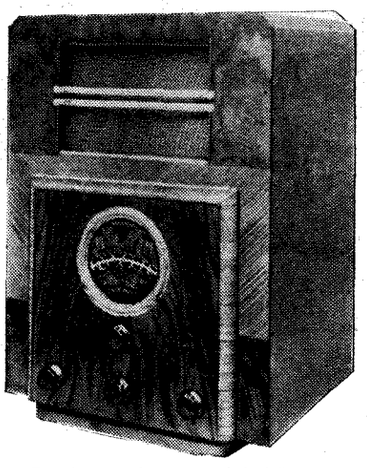


Mullard MB3 battery receiver.

Alba battery sets are fitted with iron-cored coils in both 2-circuit and 3-circuit models.

SPECIAL-PURPOSE RECEIVERS

UNDER this convenient heading it is proposed to describe those sets which do not fall readily into any of the other classifications. Some, perhaps, are not strictly "special purpose"; they set



Beethoven frame-aerial AC set.

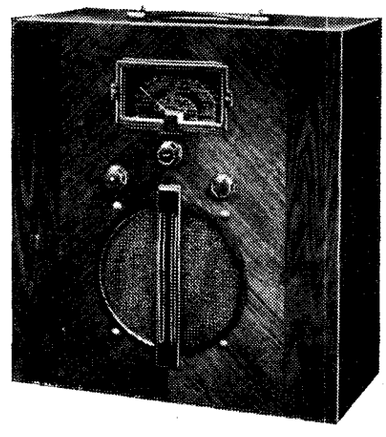
out to do very much the same as the more standard sets, but they do it in a sufficiently different way to warrant inclusion in this section.

By far the most widely used of all the specialised receivers are, of course, the portables. This year the tendency evident last season to make the portable much more compact and light than previously has become fairly general, and there are quite a number of loud-speaker sets weighing between 10lb. and 15lb. or so which truly merit their title. All other things being equal, the performance of these receivers cannot equal that of the larger sets, but in almost every case it is perfectly adequate for reasonable requirements, and the gain in portability more than offsets losses in other directions.

One of the new lightweight portables is the Beethoven "Baby," which includes a standard 4-valve circuit with full-sized valves and a 70-volt HT battery. The weight is only a little over 10lb. A somewhat larger suitcase model with a 108-volt battery weighs 18½lb.

Milnes are showing a midget portable in which extreme simplicity has been obtained by making the set cover only the medium waveband. Externally the Ever Ready portable is of the conventional small suitcase pattern, but the loud speaker is conveniently mounted on a hinged baffle which folds down into the body of the case.

At last year's Show the small Wayfarer portable attracted a good deal of attention. This year there are to be three types, the latest introduction being a Major model, with full-sized valves and a moving-coil speaker, which is stated to weigh only 13lb. Details will be available later. Other midget sets in the modern style, weighing under 15lb., are to be shown by Burndept and Vidor, while a



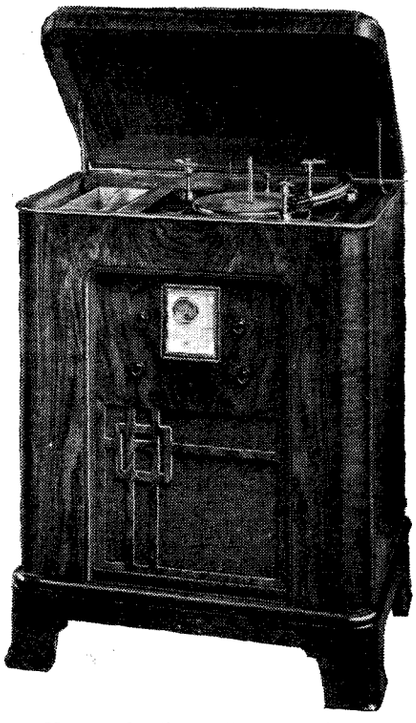
Ever Ready battery transportable.

companion set to the well-known McMichael portable has been introduced in the form of a lightweight model.

A self-contained mains transportable, working with a built-in frame aerial, may not be the best type of receiver to choose when facilities exist for erecting a good aerial, but it is certainly a very convenient arrangement in certain circumstances. The McMichael firm, which is one of the pioneers of this type of receiver, has introduced a new model with an up-to-date specification; a high-gain superheterodyne circuit is employed in order to obtain good

New Receiver Designs—

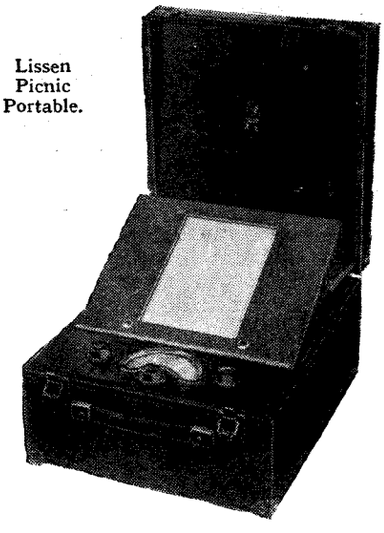
overall sensitivity in spite of the low signal pick-up of the frame. Another promising self-contained AC set is the Ekco transportable, with a nine-stage superheterodyne circuit, including a stage of signal frequency amplification and many other circuit refinements.



Haynes Quality radio-gramophone.

Another type of self-contained set is the Beethoven portable "All Electric Four," with an HF-det.-LF circuit, while Portadyne are to show an AC superhet with a self-contained aerial.

The Pye mains transportable superhet includes a bass compensator, while there is a "straight" model for those who are satisfied with a somewhat less extended range.

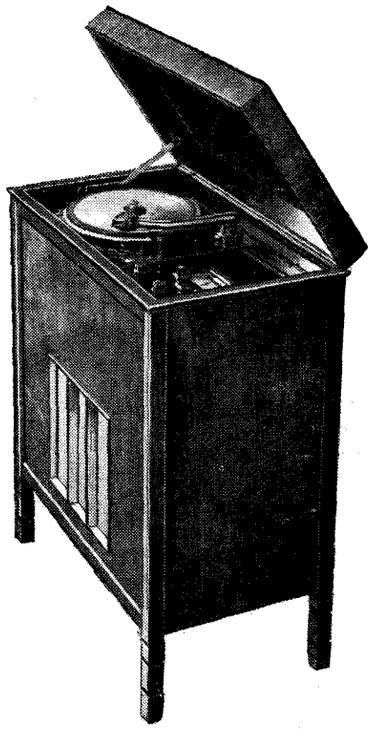


Lissen Picnic Portable.

So far as can be ascertained at the present time, there is to be only one new car radio set. This is to be shown by Ultra; it includes, of course, a superheterodyne circuit, and is remotely controlled from the steering column. Circuit details are not yet available, but the set looks neat and workmanlike. It is of the two-unit type, with the receiver chassis and speaker in one case and a separate power pack.

Several firms are specialising in high-grade non-standardised receivers planned on lines which permit of modifications in circuit detail to suit the user's special requirements and tastes. For the first time, we believe, Sound Sales are to exhibit a complete radio-gramophone embodying *The Wireless World* QA Amplifier, which is preceded by a superheterodyne radio chassis. Circuit modifications can easily be introduced as desired.

Another firm that specialises in "flexible" apparatus is Haynes Radio. The Quality Radio-gramophone which is



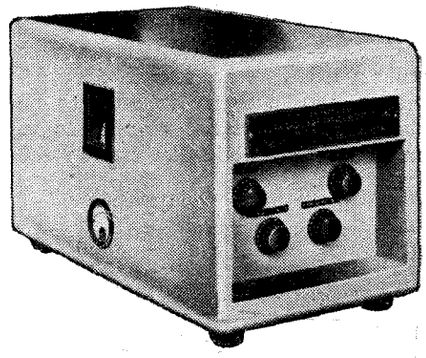
Linguaphone recording radio-gramophone.

to be shown is, in some respects, a standard instrument, but it is also a "special" set, as, by the Haynes flexible system, different unit combinations may easily be fitted as required.

C.A.C. is to show several radio-gramophones to illustrate the special cabinet styles in which the receiver chassis produced by the firm may be mounted.

Several specialised sets designed to satisfy the somewhat exacting requirements of broadcast reception in schools are to be shown; all of these have been passed as suitable for their purpose by the Central Council for Schools Broadcasting. The R.I. sets include HF-det.-LF and superheterodyne circuits, while the Film Industries equipment is mounted on a base fitted with castors in order that it may be moved from room to room. This set can feed up to eight extension speakers. The Haynes Radio set has also been passed for schools use.

Another specialised receiver is the hospital set to be shown by R.I. The smaller 5-watt model is normally arranged to feed

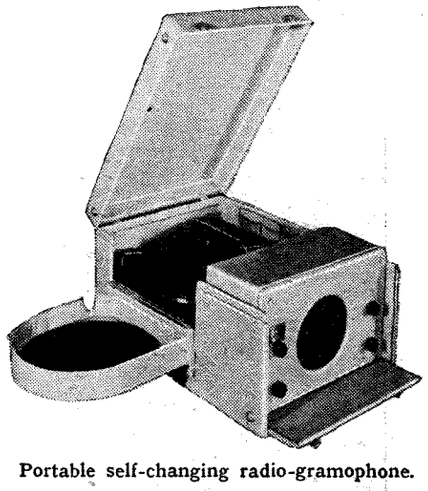


R.I. 5-watt hospital set.

five external speakers, while larger rack-mounted receivers include a 5-valve superheterodyne feeding either a 10- or 20-watt amplifier as desired. Apart from their use in hospitals, these sets are, of course, suitable for other similar institutions.

Another unusual piece of apparatus is the portable automatic radio-gramophone produced by Self-Changing Gramophones. This extremely compact unit embodies a standard superheterodyne circuit and plays from one to eight 10in. records, automatically repeating or changing at will.

The Linguaphone Recordiogram, produced by a firm which specialises in the use of the gramophone as an aid to learning languages, is a compact radio-gramophone and home recorder which, in addition to its obvious attractions from an educational point of view, has distinct entertainment value.



Portable self-changing radio-gramophone.

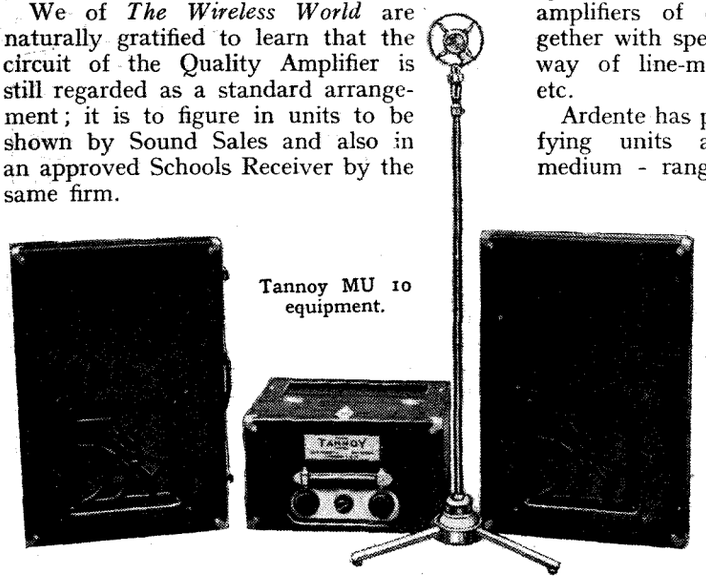
AMPLIFIERS AND PA EQUIPMENT

THE increasing importance of sound amplification will be reflected in the number of exhibits dealing with this subject. There can be no doubt that the general level of reproduction is steadily

New Receiver Designs—

improving in quality, but no startling technical developments have appeared so far.

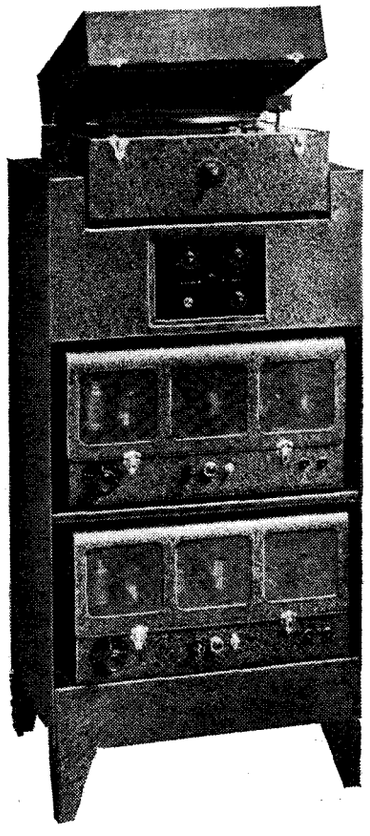
We of *The Wireless World* are naturally gratified to learn that the circuit of the Quality Amplifier is still regarded as a standard arrangement; it is to figure in units to be shown by Sound Sales and also in an approved Schools Receiver by the same firm.



Tannoy MU 10 equipment.

Another new Sound Sales production is a domestic 4-watt amplifier at the low price of £10. Two PX4's are used in push-pull and the response is stated to be virtually level up to 10,000 cycles. There is also a new 12-watt self-contained amplifier also with PX25 output valves for public-address work.

A wide choice of amplifying equipment is to be shown by Tannoy. Much of the



Ardente amplifier rack No. 2040.

larger gear is mounted on standard type P.O. racks, though the smaller amplifiers are of more conventional form; a typical example of this type is the U5, rated at 6 to 8 watts and suitable for many purposes.

Haynes Radio is to show duophase amplifiers of different ratings, together with special equipment in the way of line-matching transformers, etc.

Ardente has produced many amplifying units and, incidentally, a medium-range "quality" radio tuner unit for use in conjunction with them. There is also a radio-tuner-mixer. The Ardente transportable amplifier operates from a 6-volt car battery and is a self-contained unit. An interesting piece of apparatus in which sound amplification technique is employed is the Ardente Aurameter for determination of the degree of deafness.

One of the most recent Prism productions is a complete sound-reproduction equipment giving 8 to 10 watts and embodying a playing desk, radio chassis and microphone gear, the whole being mounted in an oak cabinet. A two-channel amplifier with associated equipment for hotels and similar institutions is also produced in various output powers up to 65 watts.

One of the most compact of the portable equipments is the "Baby" model to be shown by Film Industries. It is battery operated, with Class "B" output, and is supplied complete with a horn speaker and microphone. The Heayberd portable AC/DC amplifier is ingeniously constructed in such a way that the sections of the hinged case in which the speaker and amplifier are fitted can be taken apart to form self-supporting stands.

Among the many other equipments which will be on view is an interesting 10-watt Armstrong amplifier which includes a pre-amplifier stage for microphone use. This instrument is supplied complete with a Rola G12 speaker for 10½ guineas.

On the Short Waves

[In the absence on holiday of "Ethacomber," who regularly compiles these notes, his contribution has been undertaken by a colleague this week.]

THERE has been a noticeable increase in sunspot activity during the fortnight under review, and at no time was the sun completely clear of sunspots. This is the first sign of the increase in activity which apparently reaches its maximum during the spring and autumn equinoxes. At the time of writing, even with the rather limited magnification available at the observation post, 12 spots of various sizes are clearly visible, which is an improvement over July, when on several days no activity was visible.

No particular improvement in the reception of the higher frequencies was noticeable, but there was considerable liveliness on all bands. The 15 Mc/s broadcast band was still active at midnight, and the 11 Mc/s band was very good programme value at 01.00 GMT.

It was interesting to note that JVH Tokio on 14.6 Mc/s was of good entertainment value at 20.00 GMT. on August 4th, as this is approx. 0400 in Tokio and the route is over the North Pole, which indicates high ionisation levels over a route that is nearly all in darkness. There is a certain amount of evidence to show that the action of solar activity during summer-time conditions is not so marked during daylight, but is most noticeable after sunset when instead of the usual fade-out of the higher frequencies they "remain in" with undiminished strength, indicating that the "bending" is still adequate. On the other hand, the lower frequencies apparently suffer little attenuation and are, therefore, also good signals. W2XAF 9.53 Mc/s was a consistently good signal whenever checked after 23 00 GMT. (Jeloy having closed down) and PRF5 (9.5 Mc/s) was also very good up to 23.00 GMT.

Another point of interest during the past week was the use Zeesen was making of his transmitters on the "Programme Addressed Material" Service, a list of which was given by "Ethacomber" in May. Several of these were intercepted and were really R9 + signals sending programmes to Cairo, Tokio and other parts of the world. Incidentally, Zeesen appears to have taken into service his new 40-kW broadcast transmitters, and his signals in the 9 and 11 Mc/s band have at times been just about the strongest SW signals I have ever interrupted, backing the volume indicator on the set full over. One or two attempts have been made to check the South American stations on the 6 Mc/s band, but the resulting noise is generally beyond the capabilities of a 7-valve superhet. Measurements show that some of these stations are working within 1 Kc/s of each other, and even a "crystal gate" would have to work extremely well to separate stations under these conditions.

HJ3ABD Bogota on 6.054 Mc/s was a fairly good signal on August 7th about 23.30 GMT., but there was an unstable 5 Kc/s heterodyne on him which reduced the programme value considerably. W2XE on both 15.27 Mc/s and 11.83 Mc/s was again quite a good signal during the week, as was W2XAD 15.33 Mc/s when checked, but this station had a tendency to slow deep fading which gave the set's AVC. an excellent opportunity for exercise.

I must apologise for the lack of real DX notes this week, but as the relative noise level between "Ethacomber's" location and mine is about 10 : 1, unless a signal is about 50 microvolts it is submerged in the noise level, and it is therefore interesting to note that whereas the 15 Mc/s U.S.A. broadcasters were fairly good to good during the period under review, the 14 Mc/s U.S.A. amateur transmitters were readable only at odd intervals, although it was evident that they were having quite a good bag of WSO's with English and European amateurs.

It is probable that the present good conditions will continue for another week at least, as there is one new group of spots which will take the usual 13 days to travel across the sun's disc and ionisation level should therefore remain on the high side. H. W.

Has Quality Improved?

PRESENT DAY SETS FROM THE ACOUSTIC STANDPOINT

EVERYONE likes to own a set which is capable of reaching out for a variety of home and foreign stations, but it is safe to say that the majority of sets are chosen for their tonal quality. The prospective purchaser goes to a dealer and asks for a demonstration of a few representative sets and it is only natural that he will try to form an opinion on the type of programme—dance music or perhaps talks—in which he is principally interested. He will have no difficulty in finding the right kind of "tone" to satisfy his requirements and the price will be quite reasonable, for although reproduction of the cheaper sets shows a tendency to run to type, the minor inflections of tone are infinite.

The man whose listening tastes are catholic is not in such a fortunate position. The resonant bass and shrill upper register which enhances the rhythm of and gives a sparkling quality to his favourite dance band will render the talks of Professor Plankton even more sepulchral, and Madame Schrecklich, the lieder singer will scream too much. In fact, the set with a "nice tone" should be regarded with suspicion. What we really want is "atonal" reproduction.

First Steps Towards "High Fidelity"

This sounds a somewhat negative quality and is not one to gladden the heart of the advertisement copy writer; but it is nevertheless true that the omission of certain elements from the conglomeration of sound emanating from the loud speaker has done more to advance the cause of good quality than all the additions and extensions upon which the majority of claims of "high fidelity" are based. While the majority of manufacturers have been hurriedly planting the hitherto barren territory between 5,000 and 10,000 cycles, the more discerning firms have been patiently weeding and levelling the ground already under cultivation.

To a certain extent sets in all price categories have benefited from the work which has been done in this direction. This is particularly true of the region from 1,000 to 5,000 cycles. The troughs in the neighbourhood of 1,500 cycles and the big peaks anywhere between 2,000 and 3,000 cycles which were common in the sets of a year or two ago have been traced to unsuitable cone materials and faulty distribution of cone corrugations. The remedying of these faults has involved no additional expenditure apart from the costs of research, and this year's cheap sets no less than the more expensive models will be found to give far better reproduction in this region.

When we come to the lower middle register and the extreme bass, we find a very different state of affairs. The improvements which have been made call for a definite contribution on the part of the purchaser for their effective execution.

A FEW years ago the achievement of good quality of reproduction was largely a matter of trial and error. Nowadays the underlying principles are better understood and the limitations imposed upon the designer are principally those of cost

Faulty reproduction in the bass region is primarily due to two causes: 1. Loud speaker or cabinet resonances. 2. Harmonic distortion, or, as it is sometimes called, frequency doubling. Take the loud speaker first. If resonance as a means of filling out the bass response is to be eschewed, a much larger diaphragm and its natural corollary, a more powerful driving mechanism, will be required to maintain the required amplitude over the region hitherto overlaid by the resonance. In order to maintain a level sound output down to the lowest frequencies it is necessary to allow for a progressive increase of amplitude and to attain this without cutting off peaks, calls for a design in the region of the pole pieces and speech coil which is necessarily inefficient from the point of view of energy conversion. This again calls for further increase in the size of the magnet system so that those who demand a cleaner bass must be prepared in the first place to pay for a much higher grade of loud speaker than is to be found in sets in the lower priced categories.

Importance of the Cabinet

The good work of the loud speaker designer will be completely undone unless it is associated with a properly designed baffle. The successful manufacturers are those who regard the cabinet primarily as a baffle and secondly as a piece of furniture. Appearances are easily satisfied by the wide variety of veneers now available from the timber merchants, but acoustic perfection can only be attained by heavy and correspondingly expensive construction. Also the designer may find it difficult to adhere to conventional shapes since the effective area must be maintained without adding too much to the depth which would be conducive to cavity resonance. Really good bass reproduction can hardly be expected from the table type of cabinet, and those who have reached the point where they feel that non-resonant bass reproduction is a necessity will have to direct their search among the console receivers.

On the electrical side the designer of the chassis has done much to supplement the work of the acoustic departments, and in up-to-date sets careful attention is given to image suppression, the elimination of distortion in the AVC system, the production of larger output stages and means for ensuring accurate tuning. Sets in which the foregoing conditions—electrical and acoustic—have been satisfied will give infinitely better reproduction than the majority of sets at present in use even though their frequency response may not extend above 5,000 or 6,000 cycles. Also they lend themselves to general reception of near and distant stations with the simplest of tuning controls.

Extending the Upper Register

Better quality is possible in sets which have been fitted with variable selectivity, for the extension of the frequency range up to 10,000 cycles or above can be made available for the reception of the local station while retaining the ability to narrow the response to suit distant reception conditions. But variable selectivity can be very troublesome unless it is properly carried out, and is in any case a waste of time from the acoustic standpoint unless the lower regions of the audio-frequency spectrum have previously received proper attention.

The design of a really good system of variable selectivity is not as easy as many people seem to think. The response curves of the intermediate frequency filters must expand symmetrically and should not show any serious inclinations to produce double humps. There can be little

Has Quality Improved ?—

doubt, however, that in the more expensive sets these difficulties have been successfully overcome and there are now many excellent loud speaker units capable of making full use of the extension of frequency response thus made available. Before the "high fidelity" receiver can be regarded as a finished product steps must be taken to ensure that the full range can be used under normal receiving conditions. This involves, among other things, the production of adequate filters to suppress switch clicks and other noises entering by the mains leads, and also some form of adjustable heterodyne filter to make a neat nick in the response curve at any point in the region of 9,000 cycles where a heterodyne whistle is almost certain otherwise to appear.

There can be little doubt that those who contemplate the replacement of their old set by one of this season's models can look forward to an improvement in quality which will be appreciable in all categories, but especially so where the designer has not been unduly restricted by considerations of cost.

RANDOM RADIATIONS

By "DIALLIST"

One Way with Interference

THERE'S a delightful story of a listeners' circle in a little village of Northern India. A communal receiving set had been installed and round it squatted the local worthies, listening entranced to a talk showing the undesirability of one of their hobbies —murder as a means of settling private feuds. As the speaker developed his theme, piling argument upon argument, heads were nodded in approval and they agreed that it was sound talk. All save one, who showed his disapproval by scornful guffaws together with loud and highly impolite comments. Eventually the man-made interference became too much for the rest. No committee was appointed to enquire into the matter; one of them just drew his knife and stuck the interrupter in the vitals. Then, freed from unwanted noises, they returned to their listening, and when the talk finished were unanimous in their agreement with every word that had been said.

The B.B.C. at Olympia

AMONGST the B.B.C's. exhibits at Olympia next week will be the original control panel for dramatic productions from 2LO which I have often seen in use at Savoy Hill. In its day it was thought to be one of the most ingenious and efficient things that ever happened, but it will look a queer old relic when compared with the photograph of the latest dramatic control panel which is to stand beside it. Rather a pity, I think, that they couldn't have gone one better than a photograph by having an up-to-date panel or a model of one for comparison's sake.

Another museum piece which might well have made its appearance is the first simultaneous broadcasting control apparatus from Savoy Hill. That, too, I have often seen in action, and one used to gaze awestruck when the switches enabled 2BD or 2ZY to "take" the London programmes.

Grousers and Facts

A CORRESPONDENT sends me a rather violent diatribe on the subject of the Valve Manufacturers' Association, but, like many other grousers, he is a little shaky about his facts. "Some years ago," he writes. "the 'R' valve was sold at 21s., whereas the French valves could be obtained at a quarter of that figure . . . . After the failure of expensive litigation the price was dropped overnight from 21s. to 10s. 6d." To the best of my recollection, the R valve never was priced at 21s. All were hand-made in the period just after the war, and the supply was so short that you had to wait weeks for delivery after placing an order. I believe that the first that I bought cost me 22s. 6d. The price came down not long afterwards to 17s. 6d., but there was no sudden drop to 10s. 6d. What did happen was that the appearance of the Ora valve at 15s. caused the R valve to be dropped down to a similar figure. I was never offered French valves between 1919 and 1922, but many shops supplied the Dutch valve, whose price was at first about 7s. 6d., and, later on, two or three shillings more. The Dutch valve was "soft." It thus made an excellent detector with a very low plate voltage, but it was useless as an amplifier and its life was short owing to the bombardment of its fine filament by positive ions.

I entirely agree with my correspondent that since valve manufacture is now on a mass-production basis prices are still too high. The trouble is probably that we have far too many different types of valves, and this prevents manufacturers from concentrating on the production of a few patterns in very large quantities, and therefore at small cost. What I think we need most urgently is a drastic elimination of all patterns of valves that are not absolutely necessary.

Pruning Our Valves

I believe that we could reduce our numerous types of valves very considerably without feeling the loss of those that had to go. Take battery valves, for example. Most manufacturers make over a dozen different types in the now universal 2-volt class. Two of these are screen grids of the "fixed-mu" type and a third is the variable-mu screen grid. Probably all three could disappear without much loss in favour of the vari-mu HF pentode. Next, the majority of lists contain at least four battery triodes—the HF-and-detector type, the first LF, the small power and the super power. With the HF pentode available, the HF-and-detector triode seems superfluous. And now that the aim of nearly all battery set designers is to bring the HT current down to something under 10 milliamperes, since the public will use nothing bigger than the standard capacity battery, there would seem to be no need for two different triode output valves. We could thus reduce our triodes to two: the first LF and the output types. Nor am I sure that even the output type is strictly required since we have as alternatives the output pentode, the Class "B" triode and the Class "B" pentode.

The Radio Horse

SAMMY, one of the stud of the Lancashire County Police is, I see, being acclaimed as the first horse to be fitted with radio. I fear, though, that Sammy's right to the title "The World's First Radio Horse" will not stand investigation. About a couple of years before broadcasting began in this country, I perpetrated an article on the future of wireless, which, I am glad to say, has now been decently forgotten. One of the illustrations accompanying it showed an American cow-boy on his broncho, horse and rider between them forming a complete radio receiving station. The apparatus was carried partly on the saddle and partly on the rider's back, and I remember an ingenious arrangement for the earth connection. A length of flex wire ran down the horse's near foreleg, its far end being attached to the iron shoe. Sammy, however, can claim that his equipment is not only a receiving station but can transmit as well.

Tricks of the Trade

IT was suggested recently that certain very cheap high-tension batteries of dubious origin were finding their way on to the market with several fewer cells inside them than there ought to be. Whether or not this happens nowadays I can't say for certain, but some years ago, when I had occasion to examine the internals of a large number of HTBs, I came across a good many of the cheap and nasty kind in which certain of the cell compartments were filled with blocks of wood or other things which certainly were not cells. An even worse trick, to my mind, of which, again, I have found quite a few examples, is that of putting in a few *extra* cells. Thus, a battery labelled 60 volts might contain not 40, but from 42 to 44 cells of the very poorest quality.

How it Works Out .

At first sight you might think that the maker was giving the purchaser excellent value for his money by presenting him with overweight in the matter of cells. But there is more in it than meets the eye. When such a battery is new it may show an EMF of from 63 to 66 volts on the meter, and the purchaser planks down his money thinking that he is buying something very highly efficient. But cheaply made batteries whose cells contain ingredients of the commonest quality have a very short "shelf life." The additional cells enable them to show a respectable reading on the voltmeter even when they are partly run down. The moral of all this is: Don't buy cheap, nameless batteries.

Radio-Medico

A KIND correspondent, who is a wireless operator at sea, has written to tell me more about the medical services available in different parts of the world for ships equipped with radio transmitting and receiving gear. He has looked through the list of stations which send out medical advice and finds that most civilised countries have them, though some (including, I believe, our own) make a nasty habit of debiting the ship which seeks medical aid with telegraphic charges. In view of the difficulties and the hardships of small craft which do not carry doctors one would think that medical services by radio should be entirely free of charge. Certainly help of this kind should be available at any time if an emergency arises.

The Television Position

WHAT THE PUBLIC MAY EXPECT

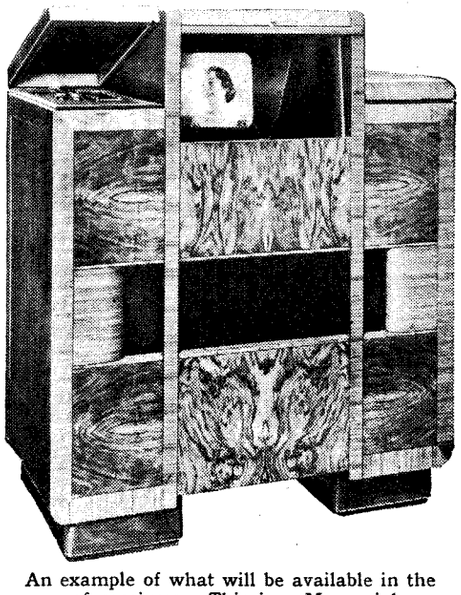
MOST discussed of all single topics at the Radio Show this year will be television. The very fact that the position is still obscure, and nobody in the radio industry who really knows anything about it will talk lest his competitors should learn something to their advantage, provokes rather than discourages argument.

It does not necessarily mean that, because the subject will be widely discussed at the Show, the public will be less interested in the other more normal wireless exhibits, or that they will be eager to place orders for television sets at once. Before any great response can be expected from the public it will certainly be necessary for opportunities to be given to judge of the capabilities of the new service. So far, very few persons indeed, in proportion to the population, have had the opportunity of seeing even the old 30-line, low-definition transmissions which the B.B.C. discontinued some two years ago.

At the moment of writing there is no positive news regarding demonstrations of television at Olympia; everything seems to depend upon whether tests now being carried out with the vision transmitter at the Alexandra Palace by the engineers prove entirely satisfactory, and the next point to consider is whether reception conditions at Olympia are sufficiently satisfactory and free from electrical interference.

Facilities are being arranged at Olympia for public demonstrations as if they were to take place, but they will be abandoned if success cannot be assured.

The Radio Manufacturers' Association organising the Show is anxious to provide some kind of demonstration of television for the public but, quite rightly, they do not favour anything which will not be truly representative of what the public may

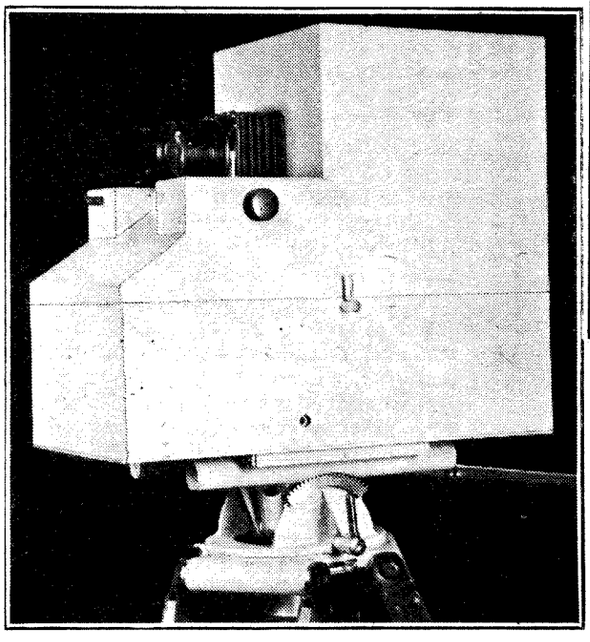


An example of what will be available in the way of receivers. This is a Marconiphone model combined with an all-wave radio-gramophone.

expect to receive with television sets in their own homes when the service begins. This means that, unless actual transmissions are received from Alexandra Palace, it is not at all likely that any alternative such as a demonstration without a wireless link, will be staged at Olympia.

It is very desirable that the exhibition authorities should maintain this attitude and decline to put up a demonstration of working television unless the receivers on which the demonstration is given are of a type which will be available to the public and the reception is carried out under home conditions.

Even if demonstrations are impossible, there will be more of a television atmosphere about the Show this year than at any previous show, for although in years gone



A Marconi-EMI television camera such as will be used for direct transmission of scenes.

by there have been examples of the old 30-line television receivers on one or two stands, this year there will be modern high-definition types of television receivers shown on the stands of quite a number of manufacturers, and although it is understood that these will not yet be for sale, nor will orders be taken at the Show for them, they will give the public a very good idea of what they may have to instal in their homes as soon as the service begins.

The sets on the stands will certainly not be shown in operation; they will be there as a kind of guarantee of "things to come."

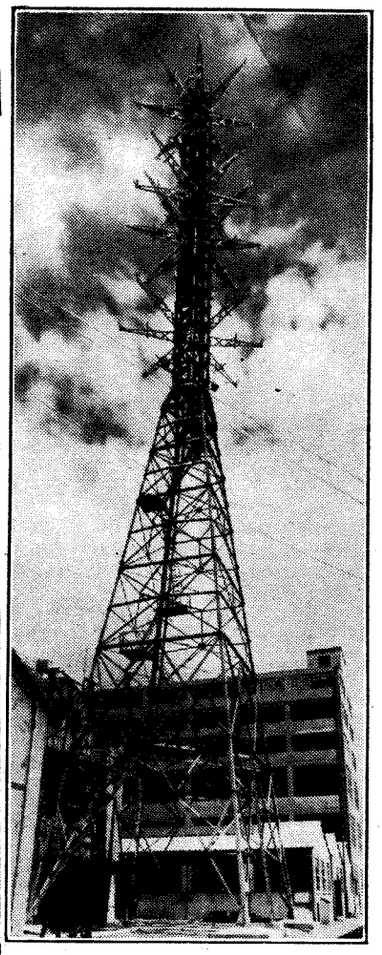
It is already known that the cost of television receivers, when they are on sale, will be high, and probably nothing will be available below £65 to £80, so that television

OLYMPIA RADIO SHOW

Two Further Special Show Numbers of "The Wireless World"

AUG. 28th: STAND-TO-STAND REPORT

SEPT. 4th: REVIEW OF THE SHOW



The television mast erected at the Hayes works of H.M.V. for experimental work in television development.

must, at the outset at any rate, be a luxury; and once again it may be emphasised that the television service is quite distinct from the broadcast service, so that the buying of ordinary broadcast receivers ought not to be affected as a result of the anticipations of the television service. In fact, one might say that ordinary broadcast receivers and television receivers are at least as distinct in identity as the ordinary type of camera and the ciné camera.

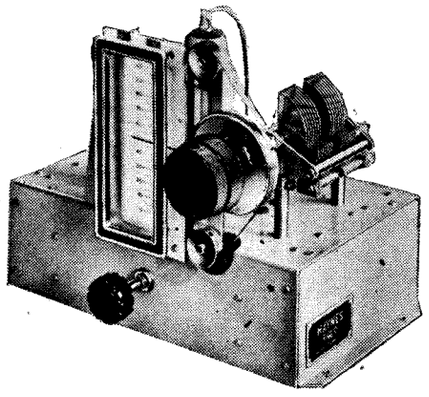
If there is still to be some delay before the television service gets going we can at least rest assured that there can be no turning back now. The B.B.C. is most definitely committed to running the television service, the money is available, and a large staff is engaged in the task of organising programmes. Several commercial companies are heavily involved financially, and we can be sure that they and the B.B.C. together are determined to make the utmost success of the project. Difficulties will yet be encountered, and temporary setbacks must certainly occur before everything is smooth running, but the inertia of the early stages has been overcome, and the project gains impetus day by day. If programmes do not arrest popular attention it will not be through lack of effort on the part of the B.B.C., and on the side of the manufacturers so much is involved that the public may be sure that the B.B.C. transmissions will not be marred through any lack of effort to attain technical perfection on their part.

Components and Accessories

Latest Products of the Manufacturers to be Shown at Olympia

THE visitor to Olympia this year in the search of new and interesting components will not be disappointed, for most of the leading component manufacturers are augmenting their respective ranges for the coming season, and will be showing for the first time many new parts representing the fruits of their labours of the past few months.

Apart from the entirely new items, improvements and modifications have been made in the majority of the more familiar parts, which may appear ostensibly the same as hitherto, if only a casual examination is made, but the critical observer will not fail to appreciate their advantages.



Haynes short-wave converter.

The workmanship and finish of the new season's products will attain a very high standard, despite the fact that in many cases prices will be lower than hitherto for articles of a similar kind, while where minor modifications have been made the improved models will in several cases bear the same price as the earlier pattern.

Perhaps the largest selection of really new components will be found on the stands of firms that include short- and ultra-short-wave components among their products. In view of the fact that a high-definition television service is shortly to be inaugurated, it is rather surprising that, so far as can be ascertained at this juncture, there are to be fewer real television parts and ultra-short-wave components than one might expect.

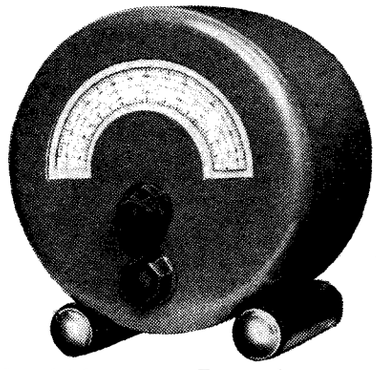
There are indications, however, that some of the component makers have this subject well in mind, as A. F. Bulgin & Co., Ltd., for instance, will be showing quite a number of new items that are essentially for use on the ultra-high frequencies. They will be showing a special HF choke with a useful range of about 3.5 to 50 metres, small coils, low-loss valve-holders and the like, also special extension-rod flexible couplers, and a series of very small capacity air-dielectric fixed and pre-set type variable condensers.

Jackson Bros. will include among their exhibits some ultra-short-wave variable condensers in single- and two-gang styles and in capacities of 15, 30 and 45 mmfds., in addition to a series of air-dielectric pre-set models of 50, 75 and 100 mmfds. maximum capacity, and, of course, with very low minimum values.

Wingrove and Rogers will include in their Polar range of condensers a similar series of pre-set condensers mounted on Steatite bases and in capacities of 25, 50, 75 and 100 mmfds. maximum at reasonable prices, while Stratton & Co. will also have a very extensive and comprehensive selection of special ultra-high frequency parts. Valve-holders assembled on high-grade ceramic plates will be a feature this year of the Lectro Linx products, which firm will have for examination also several skeleton type valve-holders mounted on short supports and for baseboard mounting that are especially well suited for use on these very high frequencies.

Television

Haynes Radio will be featuring some of the special components required for the supply units of television receivers, while high-voltage metal rectifiers for the large cathode-ray tubes are to be included in the Westinghouse Brake & Signal Co.'s exhibit. Some new H and J type models,

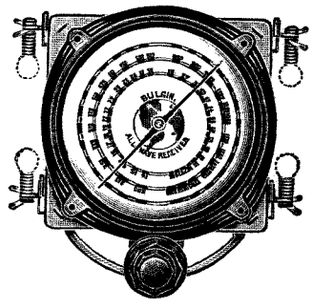


Completely screened Farrex short-wave converter.

which are very little thicker than a pencil, are now available, and some give up to 1,400 volts DC output per unit. Low-voltage types for supplying grid bias to time bases and the like will be shown also.

High-voltage smoothing condensers will be well in evidence among the products of the T.C.C. and also of the Dubilier Condenser Co., whilst mains transformers will be included in the exhibits of Sound Sales and All Power Transformers among others.

That short-wave listening is becoming more popular is evidenced by the number of converter units for adapting an ordinary broadcast set for this purpose that will be on view this year. Aeronautical and General Instruments are to show the R.I. series of Antinodal units, of which there are models covering the requirements of battery, AC and universal set users. The



Bulgin wavelength-calibrated dial.

AC model embodies its own HT supply unit, so is entirely self-contained.

The Haynes short-wave converter is of more than usual interest in that it will include an ultra-short-wave range covering the sound wavelength of the new television service. It includes five ranges and tunes from 6 to 90 metres, and is designed primarily to work in conjunction with the Haynes Two-HF tuner unit, from which it takes its HT and LT supply. Its price is £5 17s. 6d.

Eastick will have a new model for AC mains receivers, described as the A2, which covers 13 to 55 metres in two ranges, while Vidor will be showing a small compact converter housed in a metal case and covering 12 to 50 metres in one range.

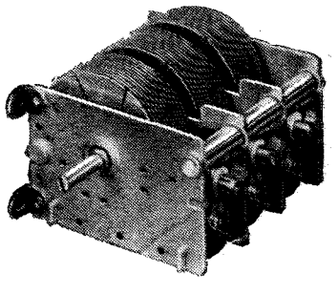
Completely screened short-wave converters will be seen on the Farrex stand; one which includes the power pack and covering 12 to 100 metres, with waveband switching, will be priced at £3 19s. 6d. A model for use with battery sets and one which takes its HT and LT from the

Components & Accessories—

broadcast set will be included in this firm's products, whilst examples of this class of unit will also be shown by Aerialite.

Among the plethora of new components introduced by A. F. Bulgin for the coming season is a range of 0.0005-mfd. tuning condensers. They are to be shown in single and gang types described as the "P" series, and appear to be of sturdy construction well suited to modern needs. Each section of the gang model is fitted with a trimmer, and they cost 12s. for a two- and 15s. for a three-gang assembly. The single unit costs 6s. 3d.

A new tuning dial accompanies these condensers, but it could, of course, be used with any other make, as it fits the

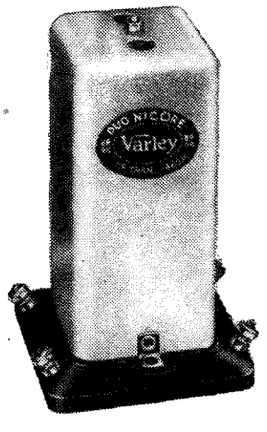


Polar Bar-type gang condenser.

standard ¼in. spindle. Described as the "P" type dial, it embodies a reduction drive mechanism, and is fitted with a double-ended pointer, and is of the pattern sometimes referred to as an aeroplane dial. The scale is protected by a glass front, which in one model is square and in another round. The square "clock-face" pattern, as it is called, costs 10s. 6d., and the round type 15s. 9d.

Wingrove and Rogers have developed a new style of assembly for their condensers, which is described as bar-construction, and this is being adopted in the new models they will show this year. A sturdy built-up steel frame is employed which is strengthened lengthwise by large steel rods, which method of construction, no doubt, accounts for the apt description it is given.

The vanes are of aluminium, and



Varley Duo Nicore 465 kc/s IF transformer.

they are assembled on a brass spindle which is supported in ball bearings. The new No. 5 condenser is a single-unit type and is made in various sizes from 0.0001 mfd. to 0.0005 mfd., while the gang models are made only in 0.0005 mfd., and each section, of course, includes a trimmer.

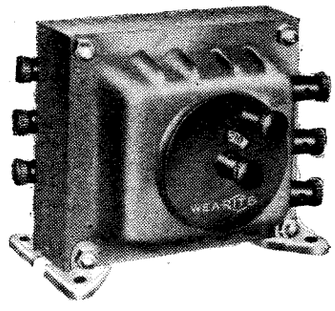
Bakelite insulation is used as standard, but both the No. 5 and the ganged assemblies are available with ceramic insulators, though this increases the price by a few shillings. For example a three-gang in standard form costs 17s. 6d. and with ceramic insulation 20s.

Further examples of gang condensers will be shown by Jackson Bros. and by the Plessey Co., the products of the latter firm being, however, restricted to manufacturers. Nevertheless, they will have some very interesting models.

Coils and IF Transformers

The iron-core tuning coil still retains its well-merited position, for Varley will have a comprehensive range of units embodying the Duo Nicore type. Adherents to straight sets will be catered for equally with supporters of the superhet, for every combination of coils can be obtained assembled on a small metal chassis and including the wavechange switch. Provision is made also for fitting a toggle pattern mains switch, which is operated by an extension of the wavechange switch rod. Alternatively, a radio-gramophone switch could be fitted in its place.

The superheterodyne units will be shown fitted with coils for use with 110 kc/s or 465 kc/s IF amplifiers, and all the new units are very compact. The BP 111

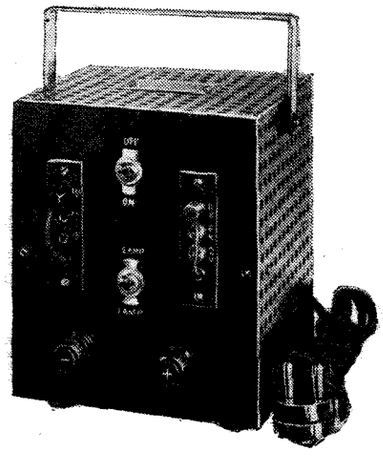


Shielded mains transformer made by Wearite.

assembly, for example, though including three coils with wavechange switch and extension for a mains switch, measures only 7⅝in. deep, 2⅝in. wide, and 4in. high. The size of coil units is undoubtedly becoming of some importance, since makers of gang condensers have been reducing the dimensions of their products year by year, and for fairly obvious technical reasons it is most desirable that the associated coil assemblies should follow suit. Varley will include also in their B.P. series of coils a fixed-coupled IF transformer for 465 kc/s which has Litz-wound coils and mica trimmers, in addition to the Air-Tune model introduced last season, and in which air-dielectric condensers are used.

Air- and iron-cored coils will be a feature of the Wearite exhibit this year, the alternative style of construction being adopted for tuning coils, as well as for their IF transformers. Wavechange switches are embodied in the majority of the coils, but there is one model, the Unigen, without. It is air-cored and described as a universal type, since it can be employed either as an HF inter-valve coupling, as the aerial coil, or a pair could be used in a band-pass filter. Intermediate frequencies of 110 kc/s and 465 kc/s are catered for in the Wearite range, and both types are to be shown in the air- and the iron-cored pattern.

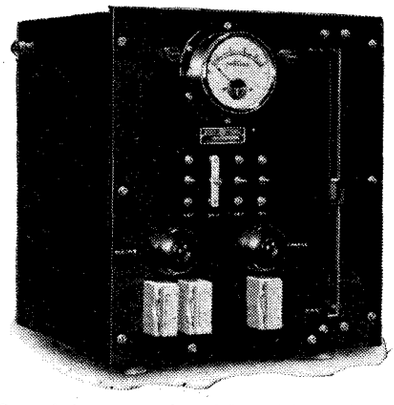
Aeronautical and General Instruments, Ltd., will be showing the R.I. Micrion coil, while the variable selectivity 465 kc/s



Heayberd portable battery charger.

IF transformer introduced last year by Sound Sales is retained for the coming season in ostensibly the same form.

Those who are interested in the construction of an all-wave type of receiver will find a visit to the Bulgin stand profitable, as among the new season's components will be a four-range coil unit. It is a binocular form of assembly and each screening can houses the coils for two wavebands. On the short waves it covers 15 to 85 metres in two stages and likewise the 200- to 2,100-metre broadcast bands, but with a break between 560 and 1,000 metres. A superheterodyne model is also available with the oscillator coils wound for use with a 465 kc/s IF amplifier.



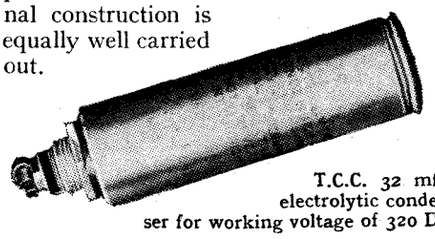
One of the new series of Sound Sales battery chargers.

A wavechange switch is not included, but the Bulgin five-way rotary type, the S122, will serve very well for the purpose. Dual-range coils, IF transformers, and a long range of short- and ultra-short-wave coils will also be included in the Bulgin exhibit.

A prominent feature of the Rothermel stand will be a complete all-wave tuning unit described as the Radio Heart. It covers short, medium and long waves, and is complete with valve-holders and all controls.

Components and Accessories—

Although the AC mains equipment is a very important part of the modern wireless receiver, the various component parts do not change much in character from year to year, but, nevertheless, improvements in construction are often effected, yet pass unnoticed. Only when a new style of construction enhances the appearance of the component does it catch the eye, but it is, no doubt, reasonable to assume that if a manufacturer takes a pride in the finish and appearance of his products the internal construction is equally well carried out.



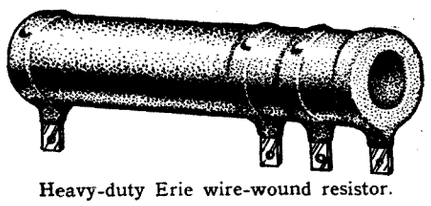
T.C.C. 32 mfds electrolytic condenser for working voltage of 320 DC.

There will be ample opportunity to examine mains transformers and smoothing chokes in various styles of finish, as some firms will be showing them totally enclosed in metal shields, while others, and even sometimes the same firm, will have on view what is usually described as the manufacturer's type. In this form all non-essential fittings, such as terminals, shielding end-plates, and the like are omitted, and, of course, these models are generally cheaper than the attractively finished counterparts.

Complete shielding, however, is not only a matter of finish and appearance, for the shielding has certain electrical advantages.

The principal firms that will show mains transformers and smoothing chokes are Aeronautical and General Instruments (R.I.), All-Power Transformers, Bulgin, Davenset, Ferranti, Haynes Radio, Heayberd, Sound Sales, Wearite and Varley.

Associated mains equipment such as battery eliminators, changers and rectifier units for converting a DC set for AC mains operation is also quite an important section, and as of old Ekco will have a range of eliminators, and so will Heayberd, while battery chargers for home and charging station use will be a prominent feature on the stands of Davenset, Diggle, Ediswan, Sound Sales and Westinghouse. Harmer and Simmons will make a special feature of AC to DC conversion units.



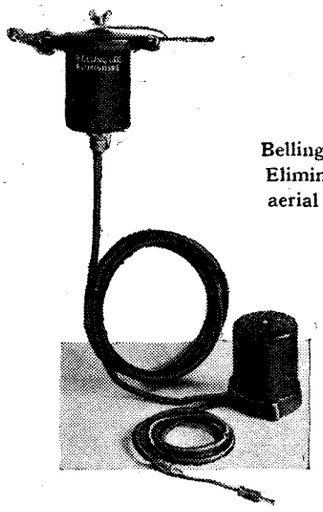
Heavy-duty Erie wire-wound resistor.

As the alternative source of power, namely, batteries, still has many adherents, users of this class of receiver will find much of interest on the stands of Britannia Batteries (Pertrix), British G.W.Z., Ewiswan, Ever-Ready, Exide and Drydex, Fuller, G.E.C., Milnes and Siemens, as there will be some new models for examination.

In connection with the supply of power for operating a wireless receiver considerable interest will doubtlessly be focused on the Electronic HT Vibrator to be shown by Bulgin this year, and for obtaining HT from a six-volt battery. It will incorporate a self-rectifying device and gives 250 volts DC at 60 mA. and costs 20s. A special transformer is used with this unit, and it is described as the Model MT2 and costs 10s. 6d., while an LT smoothing choke of 0.25 henry is also included in the equipment.

The Telegraph Condenser Co. will be showing a comprehensive range of condensers for every conceivable purpose. High voltage types, the small postage-stamp pattern, tubular paper condensers, dry and wet electrolytic models, as well as special tropical types, will constitute the principal features on their stand. Some new models have been introduced, one being a 32 mfd. size for 320 volts DC working.

An entirely new range of electrolytic condensers in aluminium cases and for



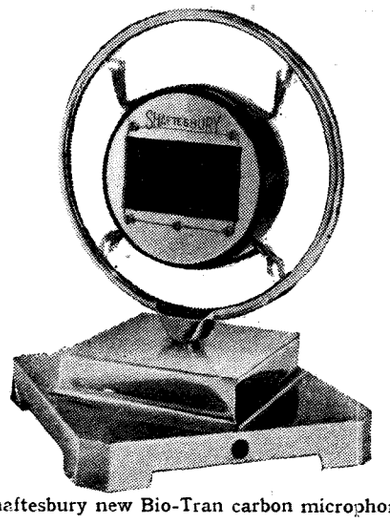
Belling-Lee Eliminoise aerial kit.

chassis mounting will be included in the Bulgin products, an interesting and useful type being the dual pattern, consisting of two condensers with a common negative connection and with positive leads brought out through the base. There will also be some low-voltage high-capacity condensers for use in grid bias circuits.

In addition, Bulgin will have for examination a host of small, yet very interesting, components and accessories, while the Radio Resistor Co., Polar-N.S.F., and Ferranti will be showing resistances and condensers among other things.

For such items as terminals, valve-holders and connectors of every conceivable variety a visit to the stands of Belling-Lee, Clix and Eastick will be well repaid, while aerial equipment will be shown by Aerialite, New London Electron Works, Belling-Lee, Bulgin, and also by Pix.

Considerable progress has been made recently in the development of sound-reproducing equipment mainly for public address work. Amplifiers and apparatus of this nature are dealt with elsewhere in this issue, but microphones, which may be regarded as separate items, since they are used by the experimenter for such purposes as home recording, might well be included in this section.

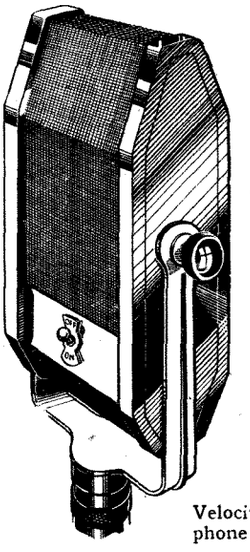


Shaftesbury new Bio-Tran carbon microphone.

The carbon microphone is still very popular and many improvements have been made in its design and construction. In this class the higher grade instruments are mostly of the transverse current type and although the output is small it is on the whole higher than with some of the alternative new patterns, so these are, perhaps, the best kind for the home recordist.

They will be shown by Ardente, Shaftesbury Microphones, Sound Sales, and Tannoy, while a good example of *The Wireless World* model may be available for examination on Eastick's stand, it being a product of Gilbert Industries, Ltd.

The three principal rivals of the carbon microphone for public address use are the moving coil, the crystal, and ribbon patterns. Moving-coil microphones have been available for some time now, and so has the crystal or piezo-electric, but the ribbon model is a comparatively newcomer in this field.



Velocity ribbon microphone made by Grampian Reproducers.

Ardente will be showing one, the price of which is £15 15s. and another example will be found on the stand of Grampian Reproducers; this costs £10 10s. Shaftesbury Microphones will also have one of this pattern for examination. There are to be several moving-coil microphones, the firms interested in them being Grampian, Wharfedale, and Whiteley Electrical, among others. Piezo-electric, or crystal, microphones will be among the Rothermel-

Components and Accessories—

Brush products of the piezo-electric type.

Servicing of modern receivers requires not only an intimate knowledge of the various sets in general use to-day, but demands the aid of comparatively complicated apparatus. Though the apparatus may be elaborate, in that it will provide the means for making the numerous tests and measurements called for in servicing work, the operation and handling of the gear can, by careful design, be reduced to simple and straightforward processes.

The Radiolab range of service test equipment is a fine example of well-made and easy-to-operate apparatus. The Universal oscillator of this make has been slightly modified and now includes a short-wave range, while a new addition is a valve-testing unit which is AC operated and will test almost every British and American valve in general use. It costs £10 10s. for testing BVA valves, and an adaptor for American valves is available at £2 2s.

The All-Purpose Tester has been modified and improved, and in its new form includes a calibrated scale for the measurement of condensers of from 0.0005 to 14 mfds.

Radiolab new model All-Purpose Tester.

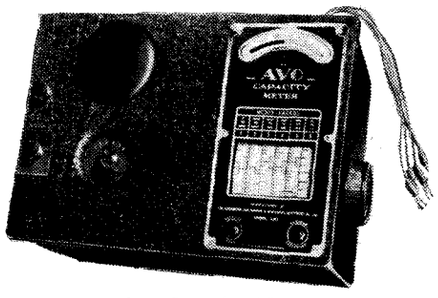
In addition to showing their versatile valve-measuring panel, which contains no fewer than 36 valve holders of different types, Radiometers will have for examination a resistance and capacity measuring bridge with direct reading scales for capacities of from 0.00002 mfd. to 25 mfds., and for resistance of from 100 ohms to 2 megohms. It is battery operated and costs £6 6s. There will be also a multi-range DC test meter for volts, current and resistance.

The Weston Electrical Instrument Co. have added a valve voltmeter to their list of servicing apparatus. It is a mains model working off the 50 c/s AC supply and allows measurements of from 0.1 to 16 volts to be made, so that among its uses would be the accurate measurement of AVC volts. It has six ranges and costs £24.

Two new output meters will be shown for use with portable testing apparatus. One has AC ranges of 2, 10 and 50 volts, and costs £5 15s., while the other, which has a constant impedance of 4,000 ohms, is a five-range instrument measuring up to 150 volts AC, and costs £9 10s.

Two new instruments of particular interest to service engineers will be shown this year by the Automatic Coil Winder Co.; one, a capacity meter, is designed to give a high degree of accuracy. For example, on the lowest range, which covers 0 to 0.0005 mfd., the scale is calibrated in steps of 5 mmfds. It has six ranges and covers all capacities up to 0.1 mfd. Operation is from batteries and the price is £21.

The other new instrument is a 46-range Avometer, which does not supersede the Universal model, but has been introduced for engineers requiring a more comprehensive test set. It has a protective cut-out and is temperature-compensated.



Avo Capacity Meter.

Other items of interest on this stand will be the new Avo Oscillator and the Avo Signal Generator, which has a short-wave range and extends up to 3,000 metres, and has an internal modulating circuit and attenuator, and is supplied with suitable dummy aerials at the price of 15 guineas.

Further examples of test and servicing equipment will be found on the stand of Wright and Weaire, whose last season's models are retained in much the same forms. As they were of advanced design, they will deal efficiently with all present-day sets.

Testing apparatus and a full range of DC and AC meters of every conceivable type will be seen this year, as in the past, on Ferranti's stand.

GRAMOPHONE EQUIPMENT

THIS section will be of more than usual interest this year on account of the fact that at least two new designs of automatic record changer will be shown. The new Garrard Model RC4 is a simplified version of the already well-known standard model and is designed to play automatically and consecutively eight 10-inch or eight 12-inch records. It will be shown as a complete assembly mounted on a unit plate ready for installation, and should afford an inexpensive means of converting existing radio-gramophones.

Records of all standard sizes from 9 in. to 12 in. may be mixed indiscriminately in the new Collaro record changer, as the machine automatically adjusts the pick-up arm to the diameter of the record to be played. Models will be shown for AC or universal AC-DC operation.

With regard to turntable motors, it is interesting to see that Kingsway Electricals will be showing, in addition to the standard Simpson turntable, a massively constructed model operating on the same principle and designed for home recording.

Among the new pick-ups the Cosmocord Model 250 is a notable example. It is housed in an original design of moulded tone arm and gives an output of 1.5 volts at 1,000 cycles and no less than 5 volts at 70 cycles. The unit includes a volume control, needle cups and a pick-up rest. In addition to their standard Model S8 piezo-electric pick-up, R. A. Rothermel will be showing a new "Junior" Model at a lower price, having a slightly smaller crystal element. Finally, the Edison Swan Electric Co. will again be showing their range of pick-ups, including the "Pezolectric," "Needle Armature," and "Minor" models.

A NEW BOOK

Cathode Ray Oscillography. By J. T. MacGregory-Morris, M.I.E.E., and J. A. Henley, M.Sc. (Eng.). 249 + xiii pages and 151 photographs and diagrams. Chapman and Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 21s.

IT is remarkable evidence of the rapid development of the cathode ray oscillograph and its applications that a volume of this size can give only summary treatment of most of the subject. An enormous amount of information has been written, but for the most part it is distributed in journals throughout the world. A book to include it all would be of impossible dimensions; the authors have therefore provided a good grounding in the fundamentals of the subject, a comprehensive study of the trend of design, and a more rapid survey of applications.

Their work is clear, logical, and well-arranged, and, although the more difficult aspects of theory are not shirked, and detailed drawings and descriptions of most types of oscillographs are included, there is no sense of being overburdened with detail. In fact the reader who approaches from the radio angle may perhaps be disappointed that applications in his field, and television in particular, are so briefly treated, while heavy engineering work with the very costly cold cathode type of instrument working up to 80,000 volts receives so much attention. But although full working instructions are not given for carrying out radio tests, it must be remembered that these details belong more to radio technique than to cathode ray oscillography. Here, as throughout the book, the authors set up plentiful finger posts showing the way to fuller treatment elsewhere. The chapter on application is, actually, most suggestive and helpful; that on television, of only 15 pages, is a mere sketch, however, and one gathers that it is not very close to the authors' hearts. It is a pity that in discussing television transmission, and (still more) DF work, they do not emphasise or even mention the outstanding advantage of the cathode ray tube—improved signal/noise discrimination. Also in dealing with the frequency limits of gas-focused tubes there is no reference to the recovery in focusing at ultra-high frequencies. There are a few errors, but the reviewer saw none that might cause serious obscurity. Apart from the minor irritation of the Continental castellated symbol for resistance the illustrations are generally excellent.

M. G. S.

Suppressing Mains Interference:

WHAT THE LISTENER CAN DO

THE author of this article—a Post Office engineer of wide experience in the subject on which he is writing—gives an admirably clear explanation of the various ways in which interference reaches a receiver, and describes the appropriate method of dealing with them

By J. NEALE (*General Post Office*)

IN spite of the existence in this country of a free radio interference investigation service, the primary object of which is to trace and deal with disturbances at their source, there is a steady demand for devices which can be fitted by listeners in their own homes. Even if the anticipated legislation to enforce the silencing of interfering machines is introduced, there is little doubt that this demand will continue. There are so many minor disturbances which can hardly be regarded as serious enough to warrant complaint, but are none the less very irritating to the listener, especially if he is unfortunately situated in a very congested town area. Even the switching on and off of lights in nearby houses and apartments sometimes produces loud noises, and a steady background of mush is nearly always present.

Disturbances present on the mains may enter the receiving set in one of two ways, illustrated in Fig. 1. Conduction into the set *via* the mains lead, the path marked A in the diagram, can only occur through inadequate screening or mains filtering arrangements in the set. In order to check whether this is the case it is only necessary to disconnect the aerial from its socket, turn the set up to full volume, and try to pick up the noise caused by switching a light on and off. If the set is well screened and filtered it should be practically silent under these conditions. I strongly advise anybody purchasing a new set to try this simple test before making their final choice. An all-mains portable set, of course, cannot be tested in this manner.

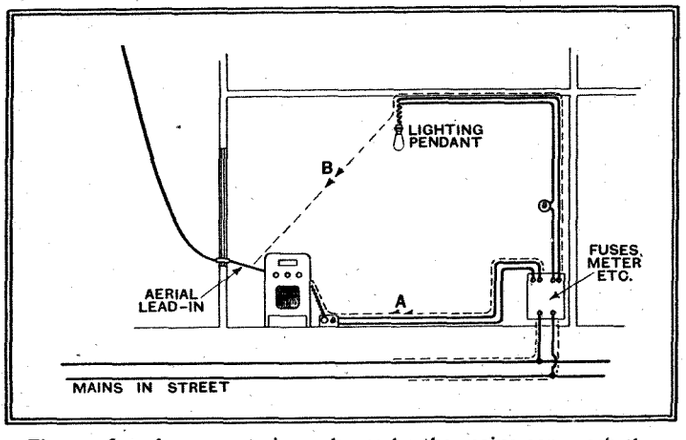


Fig. 1.—Interference entering a house by the mains can reach the receiver in two ways (A) by conduction along the mains connection, and (B) by radiation to the aerial lead-in.

More frequently the disturbances are radiated from the house wiring to the aerial lead-in, as shown by the dotted path B in Fig. 1. If an indoor aerial is in use the whole length of the aerial may be picking up interference in this way, but with an outdoor aerial only that part of the lead-in which is inside the house is normally affected. This explains why an outdoor aerial is generally so much freer from noise and mush than an indoor aerial.

How Disturbances Reach the Set—and How to Keep Them Out

Interference suppression devices for use in listeners' homes must prevent the entry of interference by path B, but it is only necessary to guard against path A when the set itself is deficient in filtering. If these facts are borne in mind the reader will be able to judge for himself the relative merits of the three types of suppression devices at present on the market, and, if it happens that he himself suffers from mains interference, decide which type is most likely to give relief in his own case.

The oldest-established suppressor is the condenser unit, which consists of two condensers, usually of 1 or 2 mfds., and two protective fuses, mounted in a small bakelite or metal container. The unit should be wired up to the house main switch or distribution box, and a lead run from it to the nearest available earth. It is most important that the three connecting leads should be kept as short as possible, as in some cases even eighteen inches of unnecessary wire will render the device ineffective. The function of the condensers is to by-pass the interfering radio-frequency currents to earth, and so prevent them from reaching the house wiring in the manner illustrated in Fig. 1.

Unfortunately, the condenser unit is not always a perfect by-pass for the disturbing currents. Some reduction of interference is nearly always achieved, but it is impossible to guarantee a complete cure without a trial. To render the filter more efficient, radio-frequency choke coils may be inserted in the mains, but as these have to carry the entire domestic load current they are comparatively expensive and are not popular with listeners.

The set lead filter has met with great success during the past year. This is a device incorporating both condensers and radio-frequency chokes, which can be plugged into the power socket from which the set is supplied, the receiver plug being inserted into a socket on the suppressor so as to complete the mains connection to the set. The connections of this suppressor are illustrated in Fig. 2.

The set lead filter was originally designed to be used with receivers which are found to be deficient in mains filtering; that is, it prevents the entry of disturbances by path A in Fig. 1. In practice, however, it has been found that quite a large proportion of radiated interference may also be prevented. This is because in many cases much of the interference picked up by the aerial lead is being radiated from the set mains lead, the two being in close proximity. I recommend that, before purchasing a set lead suppressor, the listener should make the simple test described earlier in this article to check whether his set is adequately screened and filtered. If it is, he need not buy a set lead suppressor, because radiation from the flexible mains lead to the aerial lead can be equally well prevented by other (and cheaper) means. Screening the first five or six feet of the aerial lead will achieve this, and for such a short

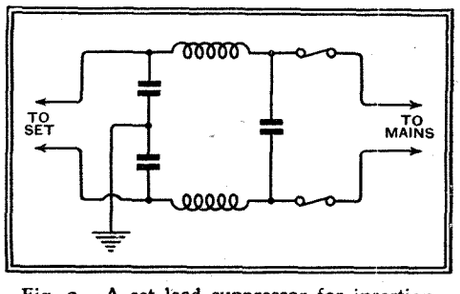


Fig. 2.—A set lead suppressor for insertion in the power supply to a receiver.

Suppressing Mains Interference—

length expensive low-capacity screened cable will probably not be necessary.

This brings me to the third method of suppression, the use of an outdoor aerial with a screened or anti-interference aerial lead-in, which is illustrated in Fig. 3. This is, in my opinion, the best method available to listeners, first, because it is much more certain to give relief than either of the other methods, and, secondly, because it does away with noises (switching "plops," etc.) originating in the listener's own house, as well as disturbances coming in from the mains.

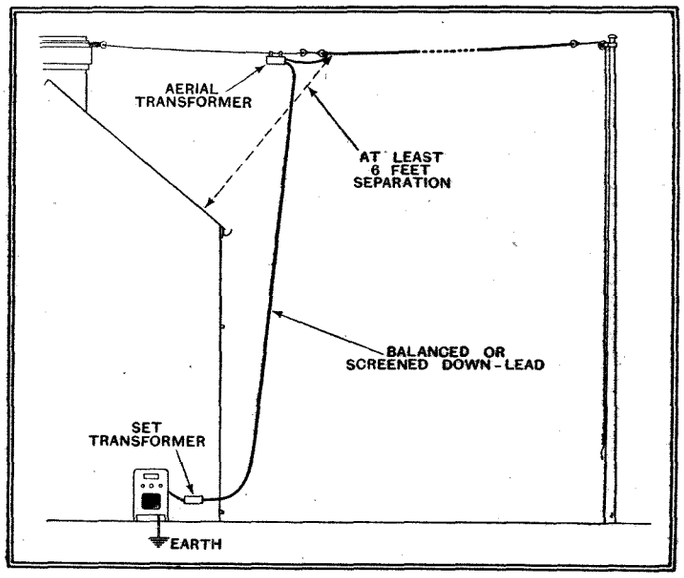


Fig. 3.—The anti-interference aerial system incorporates an aerial transformer feeding into a balanced or screened downlead, and a set transformer which is connected to the receiver aerial terminal by a short screened lead.

There are, however, two conditions which must be emphasised, as it has been found that many anti-interference aerials installed by listeners have failed to give any appreciable improvement in reception through failure to observe them. First, the set must itself be well screened and filtered. This point is easily checked by the simple test described earlier.

Filtering the Power Supply

If the set is deficient in this respect a set lead suppressor or other form of input filter unit must be provided. Secondly, the horizontal or unscreened portion of the outdoor aerial must be erected in a position clear of interference. This condition is usually fulfilled if the aerial top is at least six feet from the house at its nearest point; but if there is a tramway or trolley-bus route at the front of the house, or if there are overhead wires near the aerial, there may be some difficulty in finding an interference-free position. In such a case the listener is advised to seek the assistance of the Post Office radio interference staff, who will arrange a demonstration with temporary aerials if the situation presents unusual difficulties.

It is unnecessary to describe the construction and erection of an anti-interference aerial system, as full details are given by the manufacturers. In purchasing one of these equipments, however, the listener should make quite certain that he gets what he wants, as there are two or three quite distinct types available. Some equipments operate on medium and long waves and some on medium waves only, while the recent demand for all-wave receivers has resulted in the appearance on the market of a number of short-wave outfits. Most of the latter can also be used for reception on medium and long waves, but they do not eliminate mains disturbances on these bands and are therefore useless for radio interference suppression on normal broadcast wavelengths. They have, in fact, been designed primarily for short-wave reception, and any anti-interference properties they possess are incidental and are confined to the short waves. However, the difficulties in designing a true all-wave anti-interference aerial system are not insuperable, and at least one such equipment is now available for listeners who want short-wave reception plus interference suppression on normal broadcast wavelengths.

Transmitting Kit for 40-Metre Band

ASSEMBLED units that form the nucleus of an experimental transmitting station can now be obtained from Eugen J. Forbat, 28-29, Southampton Street, Strand, London, W.C.2. Ostar-Ganz indirectly heated valves are employed, and the apparatus is therefore suitable for use on either AC or DC supplies.

Each unit is built on a metal chassis measuring 12in. × 8in. × 3in. One is a crystal-controlled oscillator, and it includes, also, the HT supply equipment, while the other unit is a neutralised power amplifier.

The output from the oscillator is fed to the grid circuit of the amplifier by a low-impedance link coupling, and the two units can be located a reasonable distance apart without any loss in efficiency. For example, the oscillator may occupy one shelf of a rack-type frame with the amplifier on another, a method of assembly that is becoming popular with amateur transmitters, since it conserves floor space and all the equipment is readily accessible for any alterations and changes.

Only the bare necessities are included in the kit, and the choice of such accessories as meters and a transmitting key is left to the user.

Our tests were made with a kit fitted with crystal and coils for the 40-metre amateur band, and on 230 volts, 50 c/s mains. The units were equipped with Ostar-Ganz M43 pentodes, and ample excitation was available. A loose coupling, and with two turns only at each end of the link circuit, sufficed fully to load the power amplifier.

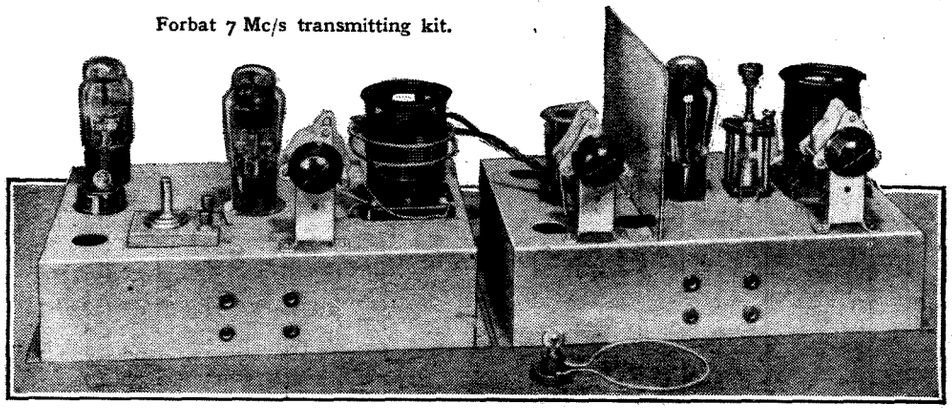
Measurements showed that after rectification and smoothing about 180 volts are available for operating the valves, and in view of this the designers have been wise in their decision to recommend the use of battery bias for the power amplifier, as between 30 and 40 volts are required.

The amplifier was given a grid bias of −40 volts and the grid excitation adjusted so that maximum power output was obtained with an anode current of 50 mA. The measured anode voltage was then 170 and the anode dissipation 8.5 watts. Under these operating conditions the HF power, measured in a dummy aerial and with optimum coupling, was 3.2 watts. This value is approximate only, but it serves to indicate that very good efficiency is being obtained with a comparatively low HT voltage.

We found it necessary to fit insulated extension rods to the condensers to eliminate hand-capacity effects, especially in the case of the PA anode circuit, for the moving vanes of its condenser are not "earthy" since the circuit is centre-tapped for neutralising the stage.

The oscillator unit, including valves, coils and a crystal for the 7 Mc/s band, costs £8 8s. and the power amplifier £4 4s. if supplied separately, or £10 10s. the two complete.

Forbat 7 Mc/s transmitting kit.



What the Public Wants. The name of the author, Mr. T. J. E. Warburton, was inadvertently omitted from the contribution under this title published last week.

McMichael MODEL 365

A RADIO-GRAMOPHONE OF DISTINCTIVE DESIGN AND PERFORMANCE

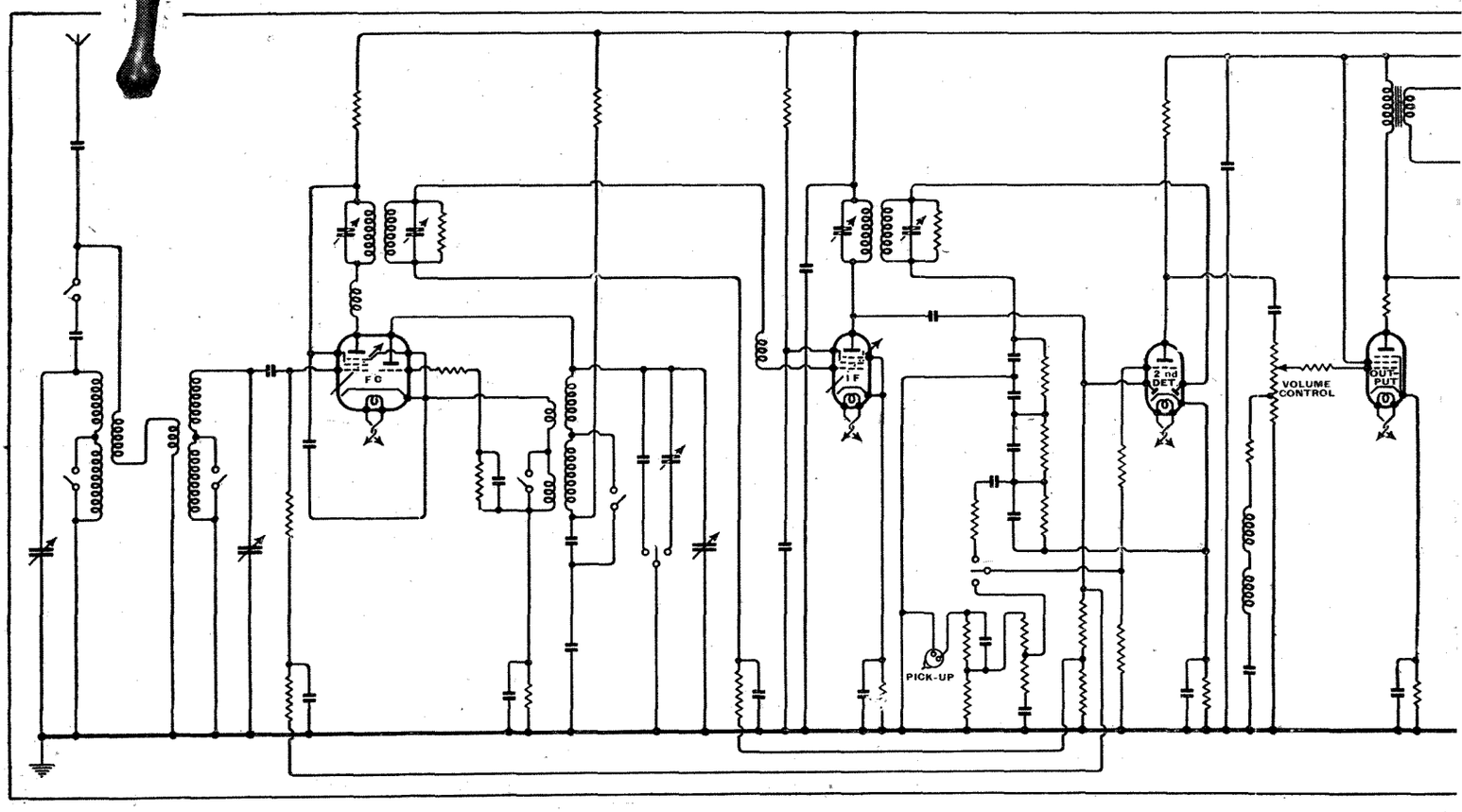
FEATURES.—Type.—*Radio gramophone for AC mains.* **Circuit.**—*Triode-pentode frequency-changer—var.-mu pentode IF amplifier—double-diode-triode second detector—pentode output valve. Full-wave valve rectifier.* **Controls.**—*(1) Tuning. (2) Volume and on-off switch. (3) Tone. (4) Waverange.* **Price.**—*28 Guineas.* **Makers.**—*McMichael Radio Ltd., Slough, Bucks.*

McMICHAEL receivers have always succeeded in preserving a certain individuality which has survived the strong undercurrents of the industry tending to divert design into certain well-defined channels. This individuality is not of the obtrusive kind bordering on eccentricity, but is, perhaps, better defined as an atmosphere of maturity.

Once again we find the outstandingly good performance on long waves previously noted in reviewing earlier models and the spacious type of quality resulting from the use of twin loud speakers. McMichael were among the first to appreciate the attraction of what has come to be termed "stereophonic" sound radiation, and have wisely decided to continue this feature in the present model.

The "Giant" tuning dial has already proved itself an invaluable aid to quick and accurate tuning, and in this instrument it is set horizontally in the top panel of the cabinet. It is matched by the turntable, which is recessed in a well at the right-hand side of the panel. Coloured pilot lights illuminate the tuning scale on medium and long waves, and the tubular white light fitted inside the lid is a great help when changing needles or records. The lighting system is controlled by contacts incorporated in the waverange switch.

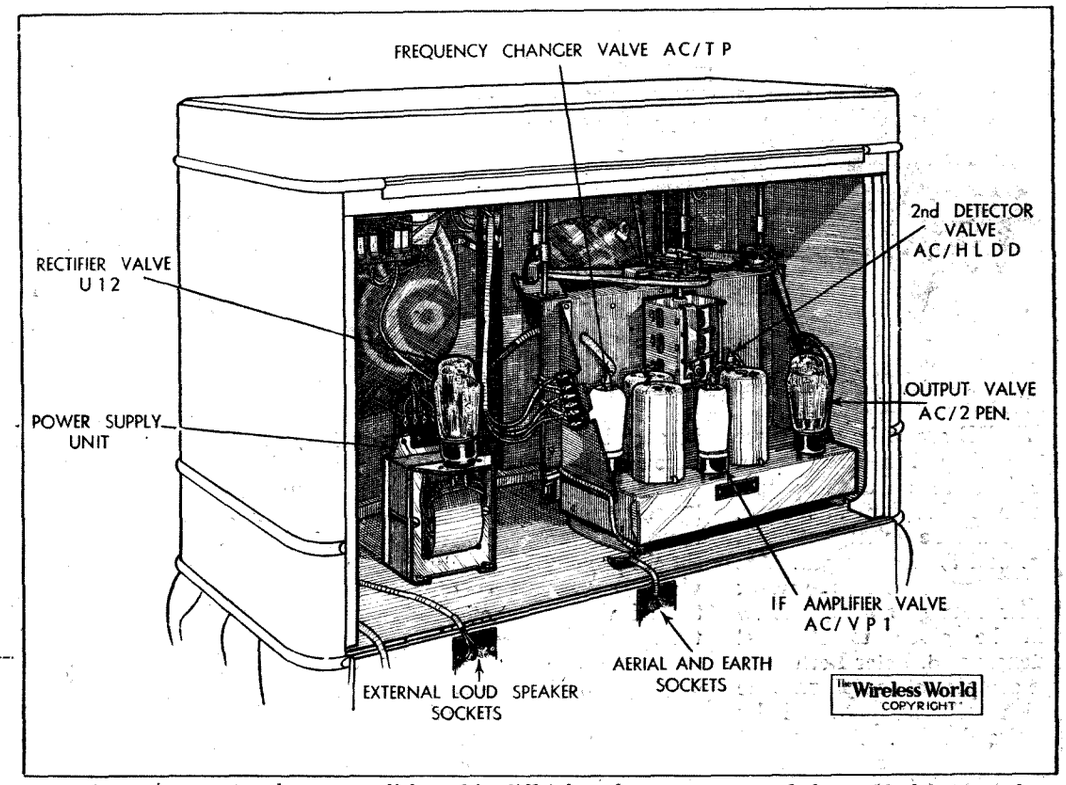
The dial and turntable are balanced at the front by the loud



speaker apertures which are set at a slight angle to give better sound distribution, and there can be no doubt that this arrangement has produced an exceedingly well-balanced cabinet design. The work has been executed in inlaid walnut and is finished by a process which combines the virtues of cellulose and french polish.

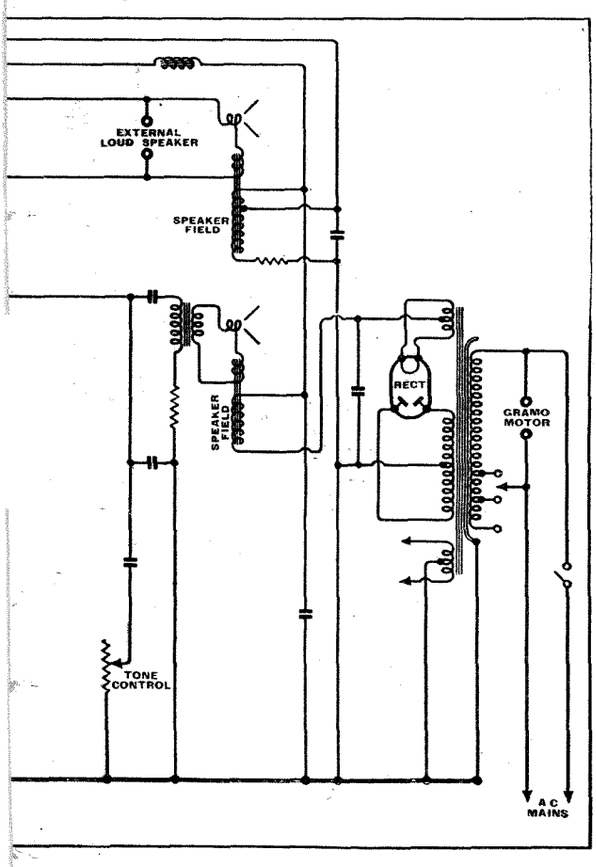
The wireless receiver consists of a four-valve AC heterodyne in which the first valve is a triode - pentode frequency-changer, the second a pentode IF amplifier, the third a double-diode-triode for signal rectification, AVC and first stage of LF amplification, and the fourth a power pentode designed to give an undistorted output of over 4 watts. The majority of circuits of this type start off with a single tuned circuit in the aerial, but in this receiver there is a band-pass input filter incorporating an efficient image suppression circuit. Special attention has been paid to the question of maintaining constant gain throughout each waverange, and there can be no doubt of the efficiency of the coil design when one applies the test of receiving the Deutschlandsender between Droitwich and Radio-Paris. This receiver not only accomplishes this difficult task but does so with consummate ease, and the volume control can be turned up and the programme of the German station enjoyed as well as that of any other station on the long-wave range. We speak, of course, of reception conditions in Central London, where the set was tested, and here the medium-wave selectivity enabled the Brookmans Park transmitters to be approached within one channel of their normal settings. It would appear, therefore, that the additional expense of an input band-pass filter in this set has been fully justified.

Most people will regard the range and sensitivity of the set as more than ample for their requirements when it is stated that at least nine Continental programmes were received in daylight with a standard of volume and quality comparable with that of our own B.B.C. Regional stations.


FREQUENCY CHANGER VALVE AC/T P
2nd DETECTOR VALVE AC/H L D D
RECTIFIER VALVE U 12
OUTPUT VALVE AC/2 PEN.
POWER SUPPLY UNIT
IF AMPLIFIER VALVE AC/V P 1
AERIAL AND EARTH SOCKETS
EXTERNAL LOUD SPEAKER SOCKETS
The Wireless World COPYRIGHT

Interior arrangement of the cabinet. The chassis has been specially adapted for vertical control from the top panel.

The four-valve superheterodyne circuit has a number of refinements including tone compensated volume control and separate output transformers for the twin moving coil loud speakers.



Tone Compensation

The interests of good quality of reproduction have been carefully studied in the design of the chassis as well as in the arrangement of the loud speaker assembly. The volume control potentiometer incorporated in the coupling between the triode amplifying portion of the second detector stage and the output valve has associated with it a frequency correction circuit designed to preserve a good balance of tone as the volume level is reduced. We were also impressed by the consistency of the performance as between radio and gramophone reproduction, and the explanation for this is no doubt to be found in the special correcting circuit of the resistance-capacity type associated with the gramophone pick-up.

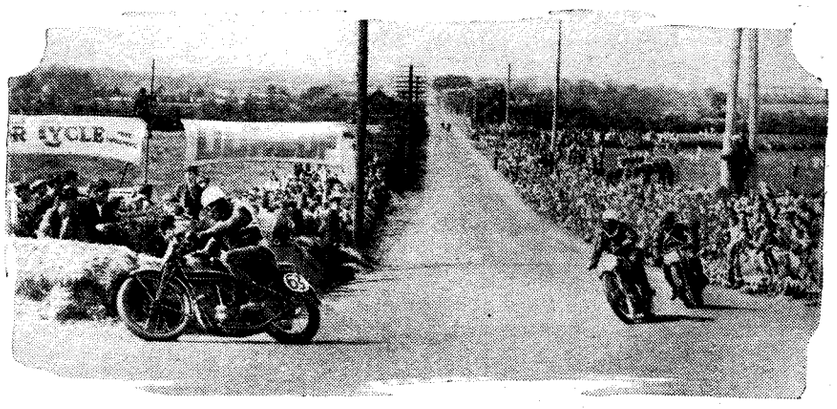
The output circuit associated with the power valve is interesting. Separate transformers are used for each loud speaker, the primary of one transformer acting as a choke for the other, which is fed through a by-pass condenser. The tone control circuit which is connected between the anode and earth is effective for both loud speakers, but naturally the small high-frequency unit is most affected, and in the low tone position hardly radiates at all.

Optimum Volume Level

The range of control is wide, and at high volume levels it is possible to produce an excess of top. This reserve will be found useful, however, in supplementing the action of the tone compensating circuits at lower levels. If the full power of the set is capable of causing an occasional resonant vibration either in the loud speaker or cabinet there is nothing to complain of in the bass reproduction at normal volumes and the lower instruments of the orchestra move within their compass with an equality of tone value and freedom from harmonic distortion.

In our opinion the set gives of its best with the volume control advanced through approximately three-quarters of its range and the tone control through one-third to one-half of the range from the position of lowest tone. With this setting the reproduction has a rich quality entirely in keeping with the character of the instrument viewed as a whole. Add to this the facility with which a wide variety of programmes can be tuned-in without interference and you have a set which can be regarded as a finished product in every sense of the term.

Listeners' Guide for the



ROUNDING CLADY CORNER in last year's Ulster Grand Prix. One of the commentators will be near this hairpin bend for the broadcast on Saturday.

THERE are to be only three variety broadcasts from the Theatre at the Olympia Radio Exhibition this year. These will be on August 27th, 31st and September 5th. The first date comes in the week under survey and the show will be given to National listeners at 8. Peter Bernard is the compère of the programme which will be produced by Charles Penley. Among the artistes billed for this evening are Stainless Stephen, who is too well known to need an introduction, Navarre, the inimitable singing impersonator, Sam Mayo and Charles Manning and his orchestra.

RADIOLYMPIA

ON the evening of Wednesday, the opening day of the Show, Leslie Baily, the well-known author of radio plays and wireless journalist, who frequently contributes to the pages of *The Wireless World*, will give a fifteen-minute talk entitled "Radiolympia" from the National transmitter at 10. He will be able to give listeners an eye-witness account of the first day of the show and a survey of its progress.

"SATURDAY AFTERNOON"

THIS is the title given to an ingenious programme devised by L. Montague which is to be given to-night (Friday) at 8 (Reg.). The idea behind it is to give a general conspectus of the English sport-lover's activity when free from his work. The sports to be dealt with include soccer, rugger, tennis, cricket, golf, darts, bowls, greyhound racing, horse racing, pigeon racing, and speedway racing. It is hoped to bring to the microphone fans and participators in each sport, and where possible someone from behind the scenes. The items will be linked by short actuality flashes, and the resultant programme should provide listeners with a vivid cross-section of the typical week-end activities of the sports-loving Englishman.

ULSTER GRAND PRIX

Two commentators will be at vantage points on the 20½-mile Clady Circuit over which the International Ulster Grand Prix will be run. They will be Graham Walker, a former Grand Prix rider, stationed at Aldergrove Corner, and Raymond Glendenning, at the Grand Stand near the famous hairpin bend at Clady Corner. Commentaries will be included in the National programme from 1.45 to 2.30 and again from 4.15 to 5.15 on Saturday.

MUSIC HALL

ERNEST LONGSTAFFE, ever on the outlook for typical radio talent, presents a strong cast of music hall artistes for his programme at 8.40 on Saturday (Nat.). Two acts make their first appearance before the microphone on this occasion. The first is Ray Meux, who is a comedian and something of a mystery. He has, under different names, played leading rôles in plays by Sheridan, Shakespeare and Molière, and has written, produced and starred in revue and cabaret. His real identity is known only to Mr. Longstaffe. The second act consists of Tom Katz and his Six Saxophonists, who are well known on the music hall stage.

Wilfred Worden, the boy pianist, who has so impressed listeners by his extraordinary technical competency and the maturity of his interpretations, will again be heard.

RENNIE'S MASTERPIECE

WATERLOO BRIDGE has frequently been brought before the public recently by virtue of its demolition. It will be interesting, therefore, to hear on Saturday at 8.25 (Nat.) from A. T. Best, who is actually taking part in the work of reconstruction, some of the difficulties encountered, technical details involved, and interesting relics unearthed.

THE PROMS

FROM the Queen's Hall at 8.45 to-night (Friday) will be heard Beethoven's Symphony No. 7 in A. On Monday, Wagner night, May Blyth and Walter Widdop, who sings Lohengrin's Farewell, will be the soloists. The programme will be broadcast at 8 (Reg.) and begins with the popular overture "Tannhäuser" and ends with "Forest Murmurs" from "Siegfried."

Berlioz's "Symphonic Fantastique" will be relayed at 8.45 (Nat.) from Tuesday's Prom. Brahms' Concerto in A minor for violin, violoncello and orchestra, with Albert Sammons, and Lauri Kennedy as soloists, is included in the portion of Wednesday's Prom to be given at 8. The Third Symphony of Arnold Bax will be broadcast at 8.50 (Reg.) on Thursday.

GERTRUDE LAWRENCE

A NEW romantic comedy, "Never Talk to Strangers," has been written by Phillip Leaver with music by Kenneth Leslie Smith, and will be broadcast at 8 on Monday (Nat.) and again Regionally at 8.55 on Tuesday.

Gertrude Lawrence will play the part of the heroine, a witty woman of the world who extricates herself with a fine panache from a series of risky

CHARLES PENLEY, the youngest son of W. S. Penley the famous comedian, who is producing the variety shows at Olympia. Left is Charles Manning and his orchestra, who are playing in this week's relay from the Theatre.

Week

Outstanding Broadcasts at Home and Abroad

GERTRUDE LAWRENCE before the H.M.V. recording microphone with Douglas Fairbanks, Jnr. She is the heroine in "Never Talk to Strangers," to be given this week.

situations. Could anything suit Gertrude Lawrence's style more accurately? The author will play opposite Miss Lawrence. Commencing on an Adriatic steamer the scene changes to Trieste and Paris and the action terminates in the Customs House at Dover.

Production is in the hands of John Watt and the strong supporting cast includes Cyril Nash, Marie Picquart, Paul Beauchamp and Joan Miller.

"THE MELODY LINGERS ON"

SELECTIONS from the works of the great musical comedy writer, Paul Ruben, will be given by Marie Burke, supported by the Variety Orchestra and Revue Chorus in the second of the series, "The Melody Lingers On" at 8.55 on Monday, Regionally. She will open her programme with the popular melody, "I Love the Moon," and close with a song that will bring back poignant memories to the war-time generation, "Your King and Country Need You."

MENDELSSOHN'S ORATORIOS

A COMPILATION by Joseph Lewis from Mendelssohn's works including the Thirteenth Psalm, Lauda Sion, Elijah, St. Paul and the Hymn of Praise, will be given in the Regional programme at 8 on Thursday under the heading "Sing of Mercies." The Aeolian Quartet, section B of the B.B.C. Chorus and the B.B.C. Orchestra (C) will be conducted by Joseph Lewis. John Wills will be at the organ. He will also be giving a pianoforte recital at 8 on Saturday (Reg.).

ALL LONDON

ON Sunday evening in the Regional programme are included three "London" combinations. At 6 will be heard the London Palladium Orchestra conducted by Richard Crean, at 6.45 the London String Players conducted by Herbert Menges, will give an interesting programme including the unfamiliar suite by Sibelius entitled "Rakastava," whilst at 9.45 the London Madrigal Group will give a recital.

FROM SALZBURG

THE whole of the third Act of Wagner's "The Mastersingers" will be relayed from the Festspielhaus, Salzburg, in the Regional programme from 8.25 to 10.25 on Saturday. The Vienna Philharmonic Orchestra will be conducted by Toscanini and among the soloists will be Lotte Lehmann, Friedrich Schorr and Kerstin Thorborg.

OPERA

THE choice item in to-night's opera broadcasts comes from the Residenz Theatre, Munich, at 7, when a gala performance of Mozart's "Magic Flute" will be given with a very distinguished cast headed by Ludwig Weber ("Sarastro"), and Anni von Kruiswyk ("Queen of the Night"). Saturday brings two classic performances from the principal French stations, and in both cases these will be relays of public performances. Meyerbeer's five-act "The Huguenots," from the Sarah-Bernhardt theatre, will be given by Paris PTT at 8. On the same evening Radio-Paris relays the Vichy Casino performance of Gounod's "Queen of Sheba" at 8.30.

Tuesday will find the air mainly occupied with the Salzburg Festival performance of Mozart's "Cosi fan tutte," with the Vienna Philharmonic Orchestra, conducted by Weingartner. Among a brilliant list of singers the name of Elisabeth Schumann, as "Despina," alone will be responsible for the tuning-in of many receivers for this broadcast.

NEW OPERETTA

ONE of the lesser-known figures of the modern Italian world of light music is Bard, whose new operetta, "Queen of the Phonograph," is being given by Rome at 8.40 to-night (Friday). It will be interesting to tune in and find out what this is all about.

AN ALL-BRITISH pianoforte recital will be given by Lance Dossor in his first home broadcast at 11.40 on Tuesday (Reg.). He recently won the Franz Liszt Prize at the International Competition in Vienna.

FRANZ LISZT

THIS famous composer died fifty years ago, and his death will be commemorated by the Berlin Station on Tuesday from 8.45 to 10 with a symphony concert, when one of Liszt's most famous works for orchestra, namely, "A Faust Symphony," will be given by the Berlin Philharmonic Orchestra and Male Voice Choir.

FOLK MUSIC

A PROGRAMME of community singing of folk songs of Upper Carinthia and the Eastern Tyrol will be relayed by Vienna at 7.10 on Sunday from Spittal-an-der-Drau.

Munich will relay from Rio de Janeiro a programme of popular Brazilian folk music at 10.30 on Wednesday.

THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, AUGUST 21st.

Nat., Shows from the Seaside, No. 6. 9.25, Stainless Stephen.
Reg., 8, "Saturday Afternoon." 9.15, British Fishing Boats: talk by Weston Martyr.
Abroad.
Radio-Paris, 8.30, Symphony Concert from Vichy Casino.

SATURDAY, AUGUST 22nd.

Nat., 1.45 and 4.15, Ulster Grand Prix. 7, The Band of the 1st Batt. the Royal Scots. ¶Sydney Kite and his Band. 8.40, Music Hall.
Reg., Recital by Vivien Lamblet (soprano). 8.25, "The Mastersingers," relayed from Salzburg. 10.25, The Grosvenor Dance Band from the Grand Hotel, Torquay.
Abroad.
Breslau, 8.10, "Musical Fireworks," from The Kurpark, Bad Warmbrunn.

SUNDAY, AUGUST 23rd.

Nat., The Luton Band and Owen Bryngwyn (baritone). 9, The Alfredo Campoli Trio. 9.30, The Bournemouth Municipal Orchestra and Stiles-Allen.
Reg., 5.30, Ballad Concert: Enid Cruickshank and Eric Greene. 7.55, Service from Bunyan Meeting, Bedford. ¶Organ Recital: Harold Darke.
Abroad.
Paris PTT, 8.30, "Martha," a four-act opéra-comique.

MONDAY, AUGUST 24th.

Nat., "Mulcaghey's Wans," from Northern Ireland. 8, "Never Talk to Strangers," with Gertrude Lawrence.

Monday, Aug 24th (*continued*).

Reg., 8, Promenade Concert. 8.55, Marie Burke—"The Melody Lingers On"—2.
Abroad.
Kalundborg, 7.30, "Pictures from Operatic History."

TUESDAY, AUGUST 25th.

Nat., 6.30, Jessie Matthews. ¶"Evergreens of Jazz," George Scott-Wood and his Six Swingers. 8.45, Promenade Concert.
Reg., 8.55, Gertrude Lawrence. 10.30, Maurice Winnick and his Orchestra.
Abroad.
Vienna, 7, "Cosi fan tutte" from Salzburg.

WEDNESDAY, AUGUST 26th.

Nat., Dorothy Hogben's Singers and Players. 8, Promenade Concert. ¶Chamber Music: Sarah Fischer (soprano) and the New Aeolian Players.
Reg., Oscar Rabin and his Romany Band. 8.45, "Salubria," a farce by Norman Edwards. 9.30, Fred Hartley and his Novelty Quintet.
Abroad.
Hamburg, 8.45, "I Pagliacci" (Leoncavallo).

THURSDAY, AUGUST 27th.

Nat., The Amington Band and George Gibbs (baritone). 8, Variety from Radiolympia. 9.10, Czigane music from Budapest. 10, "Salubria."
Reg., 8, "Sing of Mercies," from Mendelssohn's oratorios. 10.30, Nat Gonella and his Georgians.
Abroad.
Munich, 7, "Don Giovanni" (Mozart) from the Residenz Theatre, Munich.

The New Valves

Acorn, All-purpose, Deaf-Aid and Television Types

RECENT years have been noteworthy for the number of new valves introduced, and in particular for the multi-electrode frequency-changers and the multiple-diode types. Although plenty of fresh valves will make their appearance at this year's Exhibition, there are signs that the flood has been stemmed, for new valves are not so much new and revolutionary types as modifications and improvements to existing ones. It is, of course, necessary for the valve maker to retain his older valves, and will be for years to come, since they are required for replacement purposes in existing sets. No reduction, but rather an increase, in valve types is still to be expected, therefore, but it seems probable that there will be a decrease in the number of valves which can strictly be listed as current specimens.

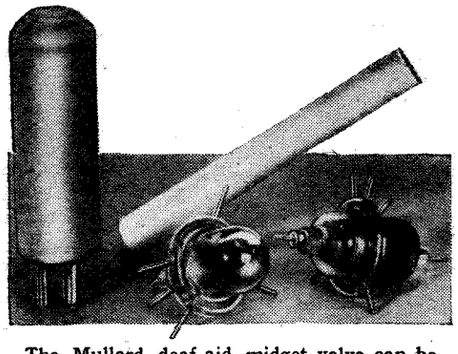
One of the few valve types which is truly new in this country is the Acorn. Osram will be showing a triode of this type, the HA1, and Mullard a triode and a pentode. The former of these is the AT4, and has a mutual conductance of 2.0 mA/V. with an AC resistance of 12,500 ohms, while the pentode, AP4, has a mutual conductance of 1.4 mA/V. and a resistance of 3.5 megohms. They are indirectly heated and consume 0.2 ampere at 4 volts. In view of their small size, the inter-electrode capacities are very low, and they are suitable for operation at frequencies as high as 430 Mc/s (0.7 metre). The triode is priced at 50s. and the pentode at 60s.

Marconi and Osram have introduced a range of AC mains valves with heaters consuming only 0.6 ampere at 4 volts in most types. These comprise the W42, an HF pentode with a "top-grid" and a mutual conductance of 1.5 mA/V., the X42, a heptode frequency-changer, the H42, a triode with a 7-pin base and a "top-grid." This triode has a mutual conductance of 1.5 mA/V. and an AC resistance of 66,000 ohms and is intended chiefly for use in resistance-coupled amplifiers. The pentode in this series, the N42, consumes 1 ampere and is capable of an output of 3 watts. The well-known S23 battery screen-grid valve is now marketed in the modern dome-type bulb, as is also the MHL4. The MH4 also has this bulb, and has been improved in that the noise level has been reduced to an exceptionally low figure. There will also be a new rectifier, the U18, rated for 250 mA. output at 500 volts.

An interesting development is the All-Purpose valve which will be shown by Harries Thermionics. This is a multi-electrode valve of the indirectly-heated type, having five grids and an anode. By connecting the valve appropriately it can be made to function as a heptode frequency-changer, a screened amplifier, a duo-diode-triode, or as an output valve of the critical-distance anode type. When used as a frequency-changer or HF amplifier, AVC bias is not applied to the control grid in the usual fashion, but to a special grid.

Output valves of the Harries type will be shown by Hivac, and the ACYY is a particularly interesting specimen, since an output of 10 watts is claimed from two in push-pull for an input of only 22 volts peak. This firm will also have a range of AC/DC type valves with heaters consuming 0.3 ampere at 13 volts, and there will also be battery valves fitted with ceramic bases for short-wave working, as well as a midget triode enclosed in a metal sheath.

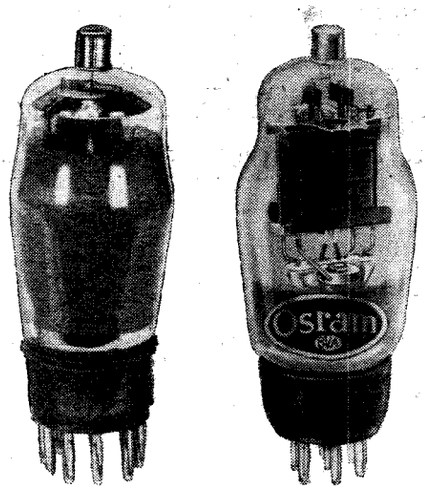
This form of construction has been adopted by Mullard for their new Deaf-Aid valves, which are of midget dimensions. The DA1 has a mutual conductance of 0.5 mA/V. and a resistance of 60,000 ohms, while the DA2 has g=0.78 mA/V. and a resistance of 9,000 ohms. Both valves are rated for 100 volts maximum anode potentials and have filaments consuming 0.05 amp. at 2 volts. This firm will also be showing a cathode-ray tuning indicator, the TV4, which comprises a triode amplifier and a cathode-ray tube built into a bulb of rather smaller dimensions than the average triode. A triode-hexode, the TH4, for AC operation, will also be on view, and for this a conversion conductance of 1.0 mA/V. is claimed.



The Mullard deaf-aid midget valve can be seen on the left, while the new Acorns are on the right compared with a cigarette to emphasise their small dimensions.

The Mazda range will include a new triode output valve. This is the PA20; it has characteristics identical with those of the PP3/250, but has a filament rated at 2 volts 2 amperes. This low voltage is adopted in order to reduce the possibility of mains hum being introduced by the LT supply when this is AC. There will also be an interesting range of transmitting valves.

British Tungsram will have a wide range of valves, among which the VP4B is worthy of mention. This valve is designed to operate with the same screen and anode voltages and has a mutual conductance of 2.8 mA/V. Its particular feature is a variable-mu characteristic which is almost exactly exponential. A triode-hexode is included in the range. The 402-Pen is one of the more interesting valves on the Cossor stand: an output pentode of the AC/DC type with a heater consuming 0.2 ampere at 40 volts, it has a mutual conductance of 7.0 mA/V. When operated at 200 volts the anode current is 40 mA. Large output triodes



The Harries Thermionics All-Purpose valve, and right, the Osram N43 output pentode for television amplifiers.

will form a portion of the exhibit of 362, and will include the PX100, a valve rated for an output of 35 watts and requiring 1,000 volts for the HT supply.

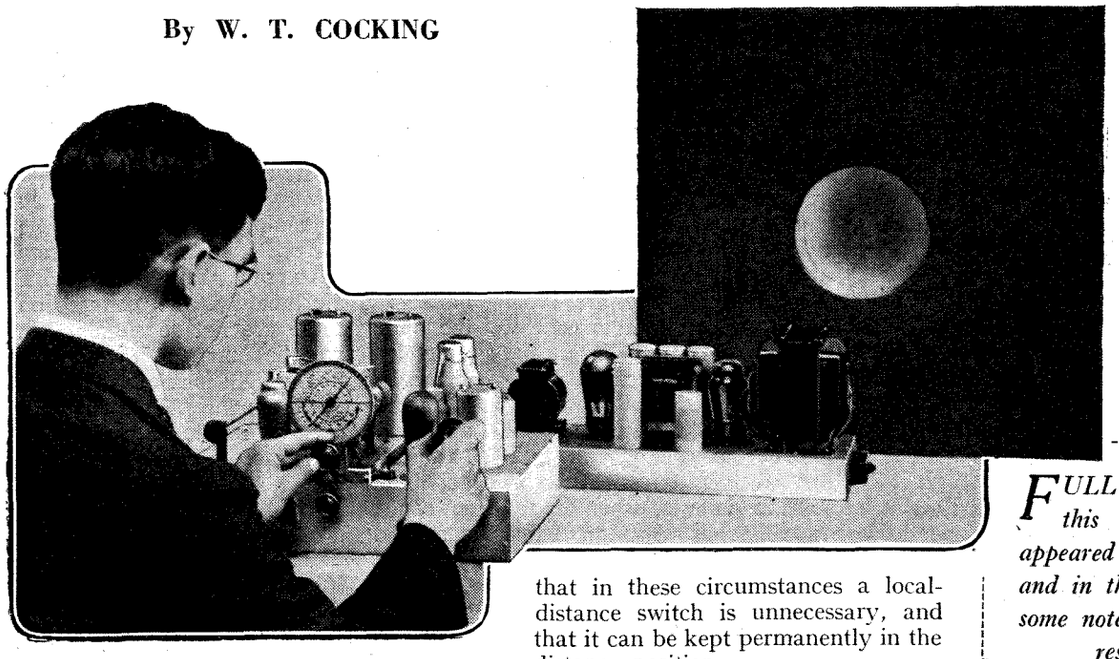
A number of firms will be showing valves developed especially for television purposes. The Mullard TSP4 is one of these, and is an HF pentode having the high mutual conductance of 4.73 mA/V. It is capable of an output of 30 v. RMS into a 10,000-ohm load for 3.4 per cent. second harmonic distortion. The Osram MSP41 is intended for use in television amplifiers, and has characteristics similar to those of the MSP4, but is rated for a screen-grid potential of 240 volts, and this enables a mutual conductance of 3.2 mA/V. to be obtained with a grid bias as high as 4 volts. This firm will also have the N43 output pentode for television sets; it is similar to the N41, but has a top-grid connection and a very low grid-anode capacity.

A number of high-voltage rectifiers for use in cathode-ray equipment will also be on view.

NOTES ON *The Wireless World*

All-Wave Super Seven

By W. T. COCKING



OPERATING THE RECEIVER

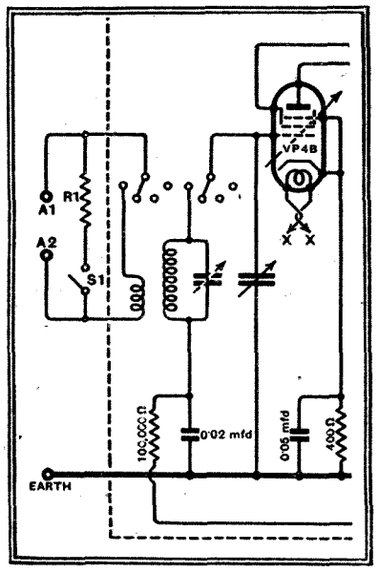
FULL constructional details of this receiver have already appeared in "The Wireless World," and in this article will be found some notes on obtaining the best results from the set.

WHEN operating on the medium and long wavebands the receiver handles in the conventional manner, and there is no point calling for special comment in its operation. While actually tuning, of course, the selectivity control should be set for maximum selectivity, which occurs when the control knob is fully rotated in an anti-clockwise direction. Provided that the IF circuits are correctly trimmed, the selectivity is then sufficiently high to permit the reception in the London area of the Deutschlandsender free from intelligible interference while both Droitwich and Radio Paris are operating. When a station has been tuned in the selectivity can be reduced as far as the prevailing interference conditions will permit.

The automatic volume control system keeps the volume more or less constant on different signals, so that the volume control needs little attention when changing stations. In the case of local reception, however, the local-distance switch should be employed, otherwise some distortion may be experienced through overloading one of the early valves by the strong signal. The switch operates by placing a 100-ohm resistance R1 across the aerial and earth terminals of the set and so reducing the aerial input. The amount of reduction required naturally depends on the efficiency of the aerial employed and upon the distance from the local station. The value selected gives the best results under average conditions, but when the aerial is poor or the distance from the local considerable sufficient input may not be obtainable. It is probable that in these circumstances a local-distance switch is unnecessary, and that it can be kept permanently in the distance position.

When the set is used unusually close to a broadcasting station, however, and particularly when the aerial is a good one, the reduction afforded by R1 may not be sufficient to prevent distortion occurring on local reception. The value of R1 should then be reduced, the correct value for local conditions being found by trial.

On short waves the operation of the receiver differs only in one particular from that on the other bands; it is necessary to operate the tuning control much more carefully if stations are not to be missed. The selectivity of this receiver, like that of all superheterodynes, is practically constant throughout the tuning range; actually, it increases slightly with increasing wavelength, but not to any important degree. The selectivity, however, appears to increase greatly as the wavelength is reduced. In reality, it is the apparent sharpness of tuning which increases, and selectivity is only one of many factors which affect this; it even depends upon the purely mechanical detail of the reduction ratio of the condenser drive!



The aerial tuning system of the All-Wave Super Seven, showing the local-distance switch.

Where the same tuning capacity is used on all wavebands it is inevitable that the sharpness of tuning should increase as the wavelength falls, for a given movement of the tuning dial covers a much wider band of frequencies. As an example which approximates to the practice of the receiver, suppose that a tuning range of 3-1 is secured on the medium waveband. The receiver will then tune over the band of 200-600 metres, or 1,500-500 kc/s; it covers a band of 1,500-500 kc/s, 1,000 kc/s in the full movement of the dial, and if this has a 100 deg. scale a movement of 1 deg. obviously means that we tune through 10 kc/s.

On the long waveband the tuning range is usually less because of the higher self-capacity of the coils. Assuming it to be 2.5-1, the range is from 375 kc/s to 150 kc/s, a band of only 225 kc/s. To cover a band of 10 kc/s we now have to move the dial not 1 deg. but 4.45 deg., so that the tuning seems much flatter.

Now, when we turn to the short wavelengths, the position is reversed. A 3-1

Notes on the All-Wave Super Seven—

range can be secured, and if this is 16-48 metres the frequency range is 18.75–6.25 Mc/s, so that the total band is 12.5 Mc/s, and in 1 deg. movement of the dial we pass over 125 kc/s instead of the mere 10 kc/s of the medium waveband. A band of 10 kc/s now corresponds not to 1 deg. but to only 0.08 deg.

Speaking roughly, these figures mean that with a station separation of 10 kc/s there would be one station at every degree throughout the medium waveband and one about every four-and-a-half degrees on the long. On the short waves, however, there would be twelve stations to every degree on the dial! In practice, of course, there are variations within each range, for straight-line frequency tuning condensers are not widely used. The figures, however, do give a general idea of the variations encountered, and they are variations which are inevitable unless the difference between the maximum and minimum frequencies is the same for each band, and this would mean a prohibitively large number of bands.

Since tuning is twelve times as critical on short waves as on medium, it is imperative to turn the control knob slowly, or quite strong signals will be passed over and missed. The receiver is not difficult to tune, but the knob *must* be turned slowly, and when a station is tuned in it is not inclined to wander once the valves have attained their normal operating temperature.

An unusual degree of constancy of tuning has, in fact, been obtained with this set, and in the course of its development it has several times happened that it has been switched off at the end of the day while tuned to some short-wave signal. Upon switching on next day, the same station has appeared without retuning. It has also been found that the AVC system has no observable effect upon the oscillator frequency. This is an important point, since if the oscillator frequency is affected by the AVC system it means that on a fading signal the set is continually mistuning itself and the good work of the AVC system is nullified.

Short-wave Conditions

Too much should not be expected on short waves, of course, for conditions are very variable. From about 15 metres to 25 metres signals are usually best in the daytime, and it often happens that after dark little or nothing can be received. The higher wavelengths, however, from 35 metres upwards, are usually best after dark, while the intermediate band seems much less affected. In London, the Zeesen transmissions on about 31.5 metres are receivable at nearly any time, one of the two stations usually being strong and the other much weaker. The Zeesen transmissions on 19 metres, however, are not nearly so reliable, sometimes being very weak indeed. Rome on about 25 metres is often very strong, but the American transmissions vary greatly. At the time of writing conditions are rather poor, and for some time it has not been possible to obtain good results on 16 metres.

In general, the 16-metre stations are the only Americans which can be received in daylight in this country, but the 19-metre transmissions are usually well received around sunset. Later in the evening the 16-metre band is usually completely dead and the 19-metre signals are poorer, but the higher wavelengths get better as time goes on.

It can be seen, therefore; that it is of little use to switch on the set at any time and expect to receive any station which appears in the short-wave list. It is necessary, first, to make sure that the time is one at which the station is working, and, secondly, to make sure that the time is a suitable one for reception on its wavelength. Finally, one should not suspect a fault because the Empire transmissions are not well received. They are often weaker in this country than American stations, partly because we are inside the skip distance and partly because directional aerials are used.

Before concluding, it may be remarked that it is possible to use 13-volt type valves in the receiver unit. There is usually no point in doing so when an AC supply is available, but when no mains are available it is possible to employ batteries. The simplest arrangement is to use 13-volt valves in the receiver, and Mullard VP13C or Brimar 9D2 are suitable types for the HF stage, with the Marconi or Osram X30 or Brimar 15D1 for the frequency-changer. The IF valves can be Marconi or Osram W31, with the same make D41 for the detector, while for the LF stage the Ferranti DA is suitable.

The D41 is, of course, a 4-volt valve, so that a resistance of 30 ohms must be wired in series with its heater. The triode is of the 7-pin type, but the normal chassis hole is large enough to permit a 7-pin valve-holder to be used without having to enlarge the hole. In order to permit this interchangeability the 5-pin valve-holder specified for normal use is of a special type requiring the same spacing of its mounting holes as the 7-pin. No changes in circuit constants are needed when using these valves, but the grid lead to the top-cap of the triode must be screened.

These valves can all be operated from a 12-volt accumulator for LT, and the HT can be derived from batteries or from a rotary converter worked from the LT battery. Unfortunately, the changes in the output stage are not so simple. In general, it will be best to modify the circuit so that the PX4 is retained and its filament heated from the LT battery with an 8.5 ohms series resistance and a dry battery for grid bias. This course is only possible if an HT supply of 250 volts or so can be obtained with a permissible current drain of up to 100 mA.

A further addition to the ranks of female announcers in Europe is seen here in the studio of the new Toulouse station. In the foreground is the musical box which produces the interval signal.

FIVE-METRE TESTS FROM MOUNT SNOWDON

ON Sunday next, August 23rd, a series of ultra-short wave tests will be conducted from the summit of Mount Snowdon by a number of North Wales amateurs. Those taking part include Messrs. G. A. Massey (G6YQ), F. J. E. Starkey (G6KY), J. H. Wood (G5YP), and A. K. Cardwell (2AKD).

Two transmitters with inputs of 10 watts operated under the call sign of G6YQP and equipped for ICW and telephony will be used. Transmission will commence at 9 a.m., and continue until 6 p.m. B.S.T.

Tests with different aerial systems will be made, and each will be identified by a code number. All reporting on reception of these tests are particularly requested to include the code numbers heard.

Several other stations are co-operating, among these being G6SL Birmingham, G5MQ Liverpool, and G6OK Llandudno.

Irish amateurs, EI6F and EI8G, will have two transmitters near Dublin, and G6AA will be working a portable set from the top of Holyhead Mountain in Anglesey.

All reports should be sent to Mr. J. H. Wood, "Deepdale," Marine Road, Prestatyn, North Wales.

THE RADIO INDUSTRY

EUSTACE WATKINS, LTD., main London distributors for Philips car radio sets, have arranged for demonstrations and trial runs near Olympia during the Radio Exhibition. The demonstration rooms will be 300 yards east of the Hammersmith Road entrance of Olympia at 32, St. Mary Abbott's Terrace, West Kensington, W.14.

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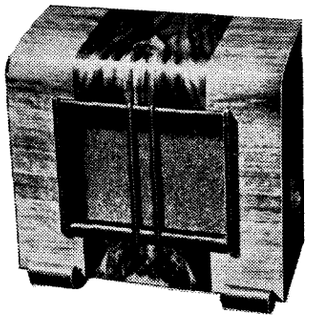
In a recent advertisement in this journal, Ferranti, Ltd., quoted their Magna All-Wave Superhet at 12 guineas; the price of this set is, however, 12½ guineas, and Ferranti, in asking us to publish this correction, wish to apologise to readers for the error.

LOUD SPEAKERS

Extension Models Quality Reproducers and PA Units

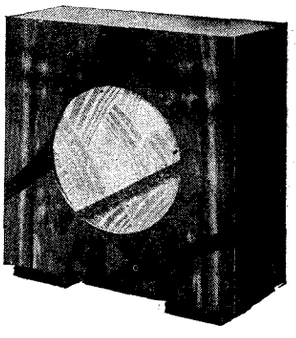
WHEN thinking of loud speakers as separate units the majority of visitors to the Show will have in mind the acquirement of a small cabinet model for use as an extension to their broadcast receivers. The range of choice, if not so embarrassingly wide as in previous years, will be found more than adequate, as the requirements, as far as



One of the W.B. Stentorian cabinet models.

output impedance is concerned, are steadily becoming standardised. The saving in cost which manufacturers have thus been able to effect in the design of transformers has been made available for expenditure in other directions, and those who contemplate the purchase of an extension loud speaker this year will have nothing to complain of in the value for money offered.

Whiteley Electrical have produced a very effective new style of cabinet to house most of the moving coil units in their range. British Rola, on the other hand, are concentrating on a single model incorporating a permanent magnet unit with an 8in. diaphragm which will be known as the "Roma."

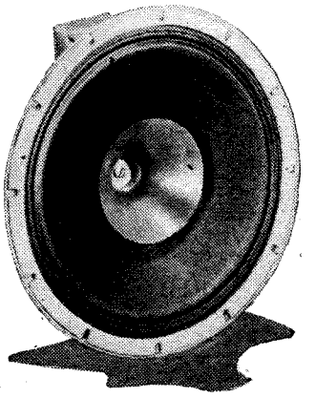


Rola "Roma" extension loud speaker

Celestion will again be showing their very comprehensive range of high-grade extension loud speakers, and a new style of cabinet has been evolved for the "Junior 8" chassis. Another unit which will make an ideal accessory to the better class of receivers is the redesigned Wharfedale "Golden." The housing of this unit in a full-length console is an innovation which will undoubtedly appeal to many people.

While on the subject of extension loud speakers mention should be made of the "Long Arm" system of remote control, which will be shown for the first time by Whiteley Electrical. This system not only gives remote control of volume, but also includes a method of switching off the receiver from the point at which the extension unit is installed. All the Whiteley Electrical "Stentorian" units, incidentally, have been redesigned, and will be shown with their new curved-sided cones and improved magnet systems, which are said to give an increase of 15 per cent. in the available flux.

Since the last Show manufacturers have been giving a good deal of attention to the extension of the frequency response towards 10,000 and 12,000 cycles, and there will be many loud speakers which will fully merit the description of "high fidelity," as it has come to be understood. Notable examples are the Goodmans 10in. and 12in. "Auditorium" speakers, in which the extension of frequency range has been effected by the use of a subsidiary cone attached to the main diaphragm. An

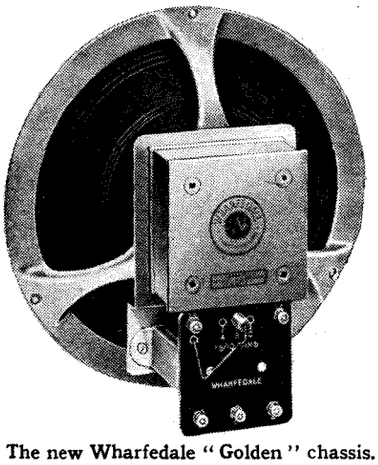


Goodmans 10 in. "Auditorium" high fidelity speaker with dual diaphragm.

entirely different method has been adopted in the Magnavox "Duode," which will be shown by Benjamin Electric. Here the active element, as far as high frequencies are concerned, is a light metal ring forming part of the speech coil assembly.

Film Industries will be showing a "high fidelity" model in the PAC5 10in. unit. An interesting feature of this speaker is that it is designed for use either in conjunction with a two-section horn or on a flat baffle, and is rated to absorb 10 watts on the flat baffle and 20 watts in conjunction with the 5ft. horn. The narrow throat horn units for PA work, with the manufacture of which this firm has been associated now for some time, will also be shown.

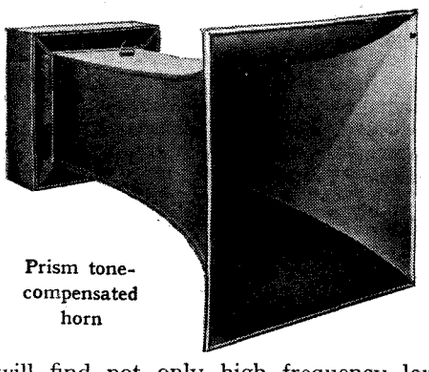
Units for PA work form an increasingly important section of the loud speaker industry, and there will be many models of the small horn-type projector utilising a standard cone diaphragm movement and having a flare diameter of the order of 24in. These instruments, whose prices average under £10, are suitable for modest amplifying equipments, and examples will be found among the products of Farrex, Grampian, Shaftesbury Microphones, Sound Sales, and Tannoy. Many of these firms also manufacture projectors designed to concentrate the sound in a horizontal plane, the Shaftesbury "Monoplana" and the Tannoy projector designed to fit on



The new Wharfedale "Golden" chassis.

the top of PA vans being examples. Sound Sales will be showing a new type of heavy-duty unit with an interesting form of dual suspension, and the Prism Manufacturing Co. break fresh ground with their tone-compensated horn in which the energy radiated from the back of the diaphragm is effectually utilised. Epoch Reproducers have added a very interesting permanent magnet model to their "super-cinema" range of speakers. This unit is fitted with a 2in. speech coil, 18½in. diaphragm, and is designed for an input of 30 watts.

In conclusion, those who have not already made themselves acquainted with the applications of piezo-electric crystals to loud speaker design should visit the stand of R. A. Rothermel, Ltd. Here they



Prism tone-compensated horn

will find not only high frequency loud speaker units but also quality headphones operating on the piezo-electric principle. There will also be at least one example of the moving-coil type of headphone, namely, the "Voluphone" on the Wharfedale stand.

Broadcast Brevities

NEWS FROM PORTLAND PLACE

Luxury Broadcast from Blackpool

THE B.B.C. has always regarded Blackpool as among the most important O.B. points on its broadcasting schedule, the wiring required being on a rather elaborate scale, due to the necessity of linking up a number of places of entertainment. Last week, however, the engineers surpassed themselves with a "Top o' th' Tower" broadcast, The wiring of ten separate O.B. points occupied a week; thirty-three microphones were used and a staff of fifteen engineers from the B.B.C.'s North Regional staff were engaged on the job.

Ten O.B. Points

The central control point was located in a room over a tea-shop near the Front, and from the portable fade unit there lines radiated, *via* sub-control points, to the ten points from which the entertainment was drawn. Two main lines to Manchester, one for the programme and the other for control purposes, were also connected with the fade unit. The programme was transmitted *via* Blackpool Post Office to the Control Room at the Manchester studios and from there to Moorside Edge, near Huddersfield.

Engineers on a Catwalk

A sub-control point was situated in a room at the back of the Tower ballroom, and from there three cables were run to the top of the Tower. Lines also radiated from this sub-point to the Tower Ballroom itself and to the Aquarium. Another sub-control point was established at the Pleasure Beach, with lines radiating to the "Grand National" switchback and other amusement centres. Microphones were installed on the track of the "Grand National," one half-way up the first incline, others half-way down the first stage. The work of installing these microphones was of a hazardous nature, the engineers having to operate from a narrow catwalk, while the continual passing of switchback cars was extremely disconcerting.

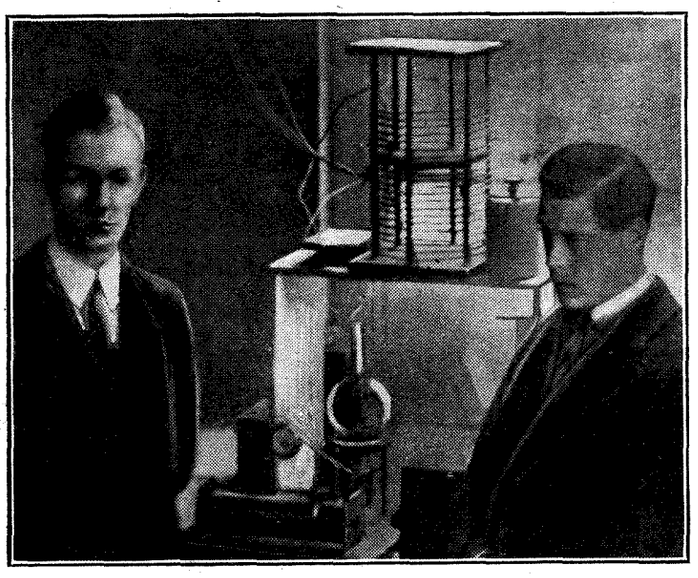
New Midland Producer

WITH Martyn Webster's transfer temporarily from Midland Region to London to produce "high spots," Archie Campbell has received orders to pack his bag and take Webster's place at Birmingham until November, when he returns to town. Mr. Campbell has produced monthly revues and various musical plays and entertainments since he joined the B.B.C. A specialist in night life entertainment, from which he recruits many of his artists, he was inquiring rather wanly of his colleagues, on the eve of his departure, as to the amount of night life to be found in Birmingham, and was recommended by a facetious fellow-producer to try the steel works.

Mr. C. W. Goyder

ONE of the early "hams"—Mr. C. W. Goyder—reaps his reward in securing the appointment of Chief Engineer of All-India Radio. He left for India by air last week.

Mr. Goyder was probably the first individual amateur to receive royal recognition, for it was in February, 1924, that King Edward, then Prince of Wales, visited Goyder's transmitting station, G2SZ, at Mill Hill School after his success in effecting two-way working with American and Canadian amateur stations.



ROYAL RECOGNITION.—A photograph reprinted from *The Wireless World* dated February 27th, 1924, of H.M. the King, then the Prince of Wales, and Mr. C. W. Goyder with the transmitting apparatus installed at Mill Hill School on which he had just previously worked with American and Canadian amateur stations. It was on October 18th of the same year that Mr. Goyder successfully conducted the first two-way communication with New Zealand.

Research Work for Empire Broadcasting

Like Lionel Fielden, now "D.G." of Indian broadcasting, Mr. Goyder graduates from the B.B.C. staff, on which he has served since the beginning of 1935 in the Research Department, concentrating on short-wave work and the development of Empire broadcasting.

Mr. H. L. Kirke, the departmental chief, has recently returned from India after setting the "A.I.R." on a sound technical basis.

Good News for Sheffield

AUTONOMY for localities in the matter of broadcasting facilities depends a good deal on the strength of local feeling and the desire for self-expression. Such has been the condition of affairs since those distant days when the P.M.G. authorised the construction of eight main stations only, and the small relays were forced out of the Post Office and the B.B.C. by local agitations. And now history repeats itself. Sheffield, which, along with other relays, lost its status with the advent of regional transmitters, has long felt that its aspirations and its local talent had practically ceased to secure an outlet so far as broadcasting was concerned. Members of the City Council were contemplating deputations to the B.B.C. in London, even as the sons of Wales did before them—with a success that Sheffield hungered to emulate. But the B.B.C. has now taken the wind out of the agitators' sails, for it has decided to provide studio accommodation near the centre of the city, to enable representatives of local interests to have readier access to the microphone. Speakers from adjoining localities in South Yorkshire and Lincolnshire will likewise have the use of this studio and be relieved of the prospect of facing a journey to Manchester if they wish to broadcast.

Toasted for Television

TELEVISION announcing at Alexandra Palace has by no means reached the glamorous stage as yet. Chiefly it consists at present of being slowly roasted under the glare of the lamps, what time Stephen Thomas and his assisting electricians experiment with lighting effects.

Leslie Mitchell and Elizabeth Cowell take turns at this game; Jasmine Bligh, happily recovering from an operation, is well out of this phase of television development.

When the programme service begins, no one will be submitted to the glare for long periods.

The Big Film

One of the best television stories comes from the Baird camp. It is common knowledge that this company has for a year or more used as its test film "I Was a Spy," which is put through the scanning apparatus perhaps a dozen times a day.

The other week a Baird engineer took a holiday in a small seaside town. Stricken with ennui on a wet evening, he dived into the local picture palace. The big picture was—"I Was a Spy."

America Tells the World

A "WORLD concert" emanating from America is to be relayed by B.B.C. and other European transmitters on Sunday, September 20th, at 8 p.m. (G.M.T.). This is one of the series of world concerts suggested by the Intercontinental Meeting of Broadcasters which met in Paris in February last.

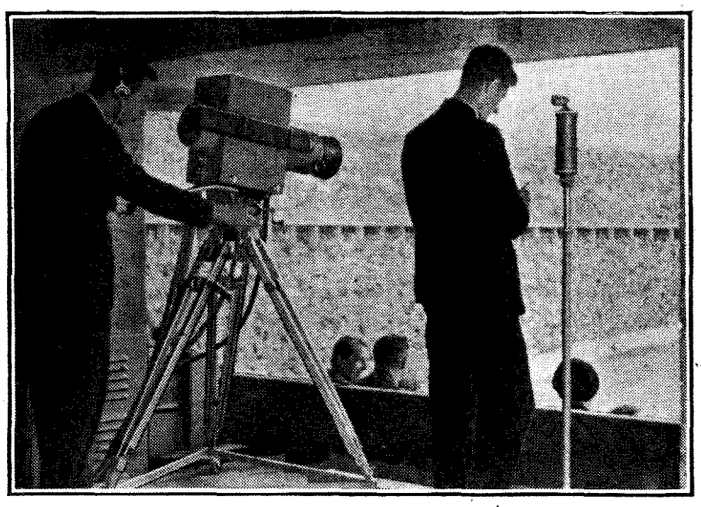
Prepared jointly by the National Broadcasting Company and the Columbia Broadcasting System, the programme will open with the roar of Niagara Falls. This will be followed by Red Indian music played by natives on a Government Reservation. Then will follow a concert composition by Sanford Skilton based on Indian themes, an original cowboy ballad to guitar accompaniment, and an American dance melody played on a Western theme.

Negroid Gems

The second half of the concert will have a negro flavour, consisting of negro spirituals and typical negro jazz band selections. Finally, this epitome of American musical art will offer examples of early Anglo-American folk melodies from the Appalachians and Eastern mountain areas.

Television at the Olympic Games

POOR SUCCESS AT FIRST— BY AN EYE-WITNESS



The Fernseh A.G. television camera in actual operation at the Stadium.

GREAT preparations were made in connection with the Olympic Games to demonstrate to the public the progress which television had made.

The German Post Office provided a number of viewing rooms with the intention that the public should have the opportunity of watching the events through the new medium. Twenty-five viewing rooms to accommodate thirty to forty persons were established, and two theatres, one to hold 100 and another accommodating 300 persons. There were, in addition, other facilities at various points outside Berlin. The transmissions were made from the Witzleben television transmitter, with 180-line definition, 25 frames, and the accompanying sound.

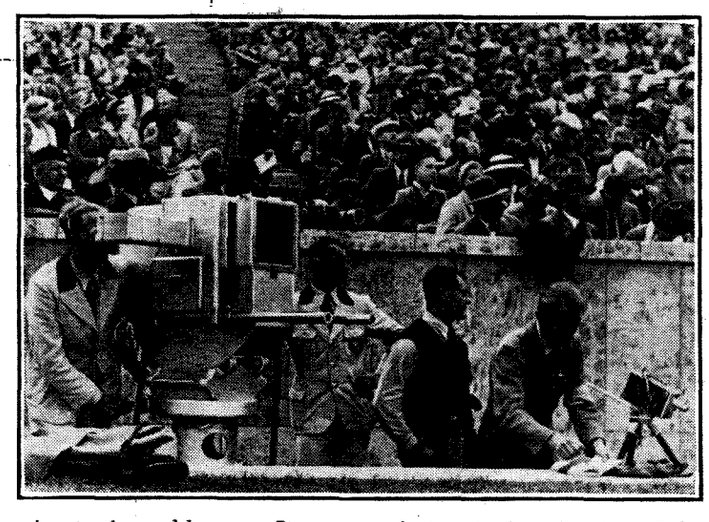
A Telefunken cathode-ray projection receiver was set up in the smaller theatre whilst a receiver operating on the intermediate film system was installed in the large theatre. But results were extremely disappointing. The pictures were so poor and the average results so far below ordinary television broadcasts that even the most sympathetic members of the audience turned away. The attempt to televise the opening ceremony gave onlookers only a suggestion of shadowy and distorted forms, and the only things which came out reasonably clearly were the inscriptions on white placards carried in front of each national team in the march past. Even here the results were assisted by the announcements by a television commentator who kept saying, "Now you see . . . ." but it was seldom that his audience could see anything identifiable.

On Sunday, the first actual day of the Games, the weather continued dull and the quality of the pictures showed no improvement. On Tuesday, the third day, the performance in the large theatre was abandoned after a long delay and the audience told that a fault in the apparatus had developed, although the engineers said good results were obtained earlier.

The projection receiver, too, was often out of use because it merely aggravated the appearance of defects with the enlargement produced by projection. In the evening, however, good results were obtained from studio transmissions.

On Wednesday, the fourth day of the Games, the scanning television cameras were still giving very shadowy pictures. The transmission of intermediate film pictures provided a pleasant change. These pictures were contrasty and quite clear, but showed a certain amount of distortion. From a film point of view they would be termed "hard," as they showed little gradation.

A Telefunken camera photographing the finish of the 100-metre course.



Later in the week the engineers appeared to get used to their apparatus, and the men in charge at the receiving end (who were quite new to the work owing to the sudden increase in the number of public rooms from ten to twenty-seven) became more used to managing the sets in their charge.

I was able to witness an exciting game of water polo on the Telefunken large screen projection receiver (cathode ray). This was being transmitted by a television camera constructed by the Post Office engineers. The 180-line definition was unfortunately not sufficient to give great detail, but it sufficed to enable me to discern the players' caps, their movements, and the movements of the ball. Contrast was good. The question of contrast seems to be the most difficult, next to synchronisation, when using "electric eyes."

These television cameras are liable to give "flat" pictures when the sky is clouded over. In Berlin three types are used: German Post Office and Telefunken examples of the Iconoscope, and the Fernseh A.G.'s television camera, which operates with secondary emission amplification, and belongs to the family of Farnsworth-type cameras.

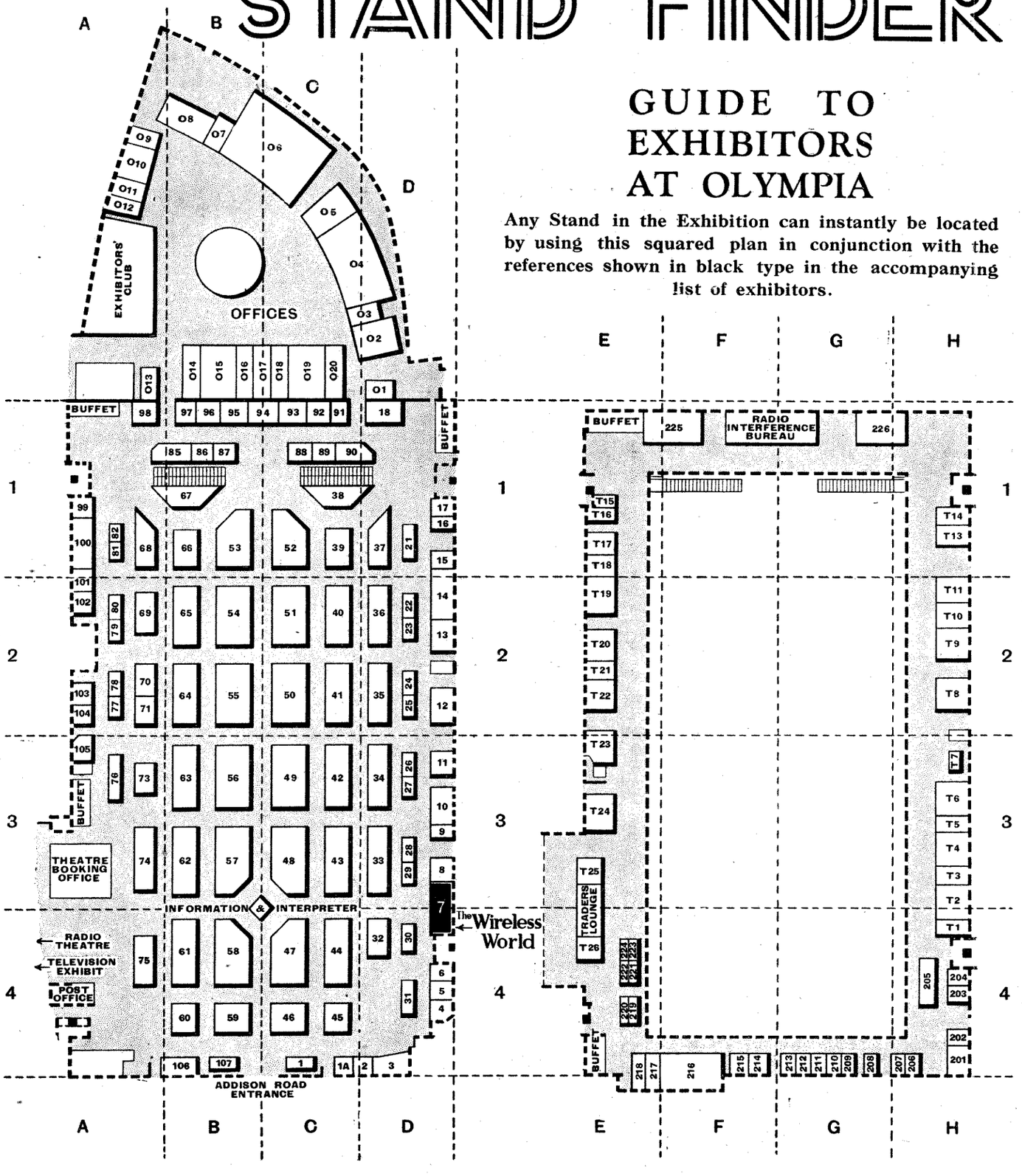
The intermediate film transmissions unfortunately gave badly distorted sound. It will be remembered that with this system there is a certain time lag so that sound has also to be recorded, the rapid developing, fixing and drying processes to which the film is submitted appear to impair the sound track.

It seems unfortunate that, in view of the poor demonstrations on the first days, the German Post Office should not have made it abundantly clear to the audiences how unreliable and experimental in character the results might be. This might have prepared them for the disappointment which was keenly felt by everyone present who had been attracted by the enthusiastic announcements which had been made in the Press.

The Wireless World STAND FINDER

GUIDE TO EXHIBITORS AT OLYMPIA

Any Stand in the Exhibition can instantly be located by using this squared plan in conjunction with the references shown in black type in the accompanying list of exhibitors.



A selection of Constructional Receivers recently described in the pages of this journal will be on view at "The Wireless World" Stand (No. 7).

Exhibitors at Olympia

ALPHABETICAL LIST WITH STAND NUMBERS AND REFERENCES TO THE PLAN OPPOSITE

Name.	Stand.		
AERIALITE, Ltd.	9	D	3
Aerodyne Radio, Ltd. ..	74	A	3
Aeronautical & General Instruments, Ltd. ..	30	D	4
All Power Transformers, Ltd.	206	H	4
Armstrong Manufacturing Co., Ltd.	224	E	4
Automatic Coil Winder & Electrical Equipment Co. Ltd.	31	D	4
BALCOMBE, A. J., Ltd. ..	41	C	2
Barratt & Robinson, Ltd. ..	226	G	1
Beethoven Radio, Ltd. ..	34	D	3
Belling & Lee, Ltd.	98	A	1
Benjamin Electric, Ltd. ..	91	C	1
Bridger, R. O., & Co., Ltd. ..	211	G	4
Britannia Batteries, Ltd. ..	71	A	2
British Broadcasting Corporation	38	C	1
	67	B	1
British G.W.Z. Battery Co., Ltd.	69	A	2
British N.S.F. Co., Ltd. ..	96	B	1
British Pix Co., Ltd. ..	209	G	4
British Rola Co., Ltd. ..	93	C	1
British Tungsram Radio Works, Ltd.	33	B	3
British Wireless for the Blind Fund	90	C	1
" Broadcaster, The " ..	T25	E	3
Brown Brothers, Ltd. ..	T8	H	2
Bulgin, A. F., & Co., Ltd. ..	1	C	4
Burgoyne Wireless, Ltd. ..	75	A	4
Burndept, Ltd.	65	B	2
Bush Radio, Ltd.	50	C	2
CADISCH, R., & Sons ..	T10	H	2
Celestion, Ltd.	24	D	2
Chloride Electrical Storage Co., Ltd.	32	D	4
City Accumulator Co., Ltd. ..	18	D	1
Cole, E. K., Ltd.	53	B	1
Collaro, Ltd.	70	A	2
Cosmocord, Ltd.	78	A	2
Cossor, A. C., Ltd.	55	B	2
Crypton Equipment, Ltd. ..	202	H	4
DALLAS, John E., & Sons, Ltd.	T23	E	3
Davies, D. M., Woodwork ..	17	D	1
Davis & Timmins, Ltd. ..	210	G	4
Decca Gramophone Co., Ltd.	44	C	4
De La Rue, Thos., & Co., Ltd.	6	D	4
Dent, R. H. (Ardente) ..	3	D	4
Department of Overseas Trade	85	B	1
Dew, A. J., & Co., Ltd. ..	T6	H	3
Dibben, Horace, Ltd. ..	T15	E	1
Diggle, Alfred, & Co., Ltd. ..	15	D	1
Dubilier Condenser Co. (1925), Ltd.	39	C	1
Dulcetto Polyphon, Ltd. ..	T19	E	2
Dyson, J., & Co., Ltd. ..	T2	H	3
EASTICK, J. J., & Sons ..	T24	E	3
East London Rubber Co., Ltd.	T9	H	2
Eavestaff & Sons, Ltd. ..	225	F	1
Econasign Co., Ltd.	222	E	4
Edison Swan Electric Co., Ltd.	42	C	3
Ensign, Ltd.	T22	E	2
Epoch Reproducers, Ltd. ..	94	B	1
Ever Ready Co. (G.B.), Ltd.	58	B	4
Everett Edgcumbe & Co., Ltd.	213	G	4
FARREX Radio	218	E	4
Ferranti, Ltd.	8	D	3
" "	63	B	3
" "	216	F	4
Film Industries, Ltd. ..	4	D	4
Flinders (Wholesale), Ltd. ..	T16	E	1
Fuller Accumulator Co., Ltd.	101	A	2
GARRARD Engineering & Manufacturing Co., Ltd.	37	D	1
General Electric Co., Ltd. ..	40, 51,	C	2
Gilbert, C., & Co., Ltd. ..	T14	H	1
Goodmans Industries, Ltd. ..	87	B	1
Gorst Electrical Co., Ltd. ..	46	C	4
Gramophone Co., Ltd., The	54	B	2
Grampian Reproducers, Ltd.	21	D	1
H.M.V. (See The Gramophone Co., Ltd.)			
Hacker, H., & Sons ..	29	D	3
Harmer & Simmons, Ltd. ..	217	E	4
Harries Thermionics ..	2	D	4
Haynes Radio	13	D	2
Heayberd, F. C., & Co. ..	25	D	2
Hendersons Wholesale Electrical & Radio, Ltd. ..	T17	E	1

"THE WIRELESS WORLD" STAND NO. 7

Henley's, W. T., Telegraph Works Co., Ltd. ..	28	D	3
High Vacuum Valve Co., Ltd.	26	D	3
Hillman Brothers, Ltd. ..	T3	H	3
Hobday Brothers, Ltd. ..	T20	E	2
ILIFFE & Sons, Ltd. ..	7	D	4
Invicta Radio, Ltd.	35	D	2
Ismay Distributors	73	A	3
JACKSON Brothers, Ltd. ..	81	A	1
KINGSWAY Electricals, Ltd.	88	C	1
Kolster Brandes, Ltd. ..	57	B	3
LECTRO Linx, Ltd.	82	A	1
L.E.S. Distributors, Ltd. ..	T21	E	2
Linguaphone, Ltd.	106	B	4
Lissen, Ltd.	64	B	2
London Electric Appliances, Ltd.	212	G	4
Lugton & Co., Ltd.	T5	H	3
MANUFACTURERS Accessories Co. (1925), Ltd. ..	T7	H	3
Marconiphone Co., Ltd. ..	49	C	3
McMichael Radio, Ltd. ..	47	C	4
Milnes Radio Co., Ltd. ..	205	H	4
Mullard Radio Valve Co., Ltd.	62	B	3
Multitone Electric, Ltd. ..	86	B	1
NEW London Electron Works	22	D	2
ORR Radio, Ltd.	35	D	2
PARTRIDGE Wilson & Co., Ltd.	107	B	4
Philips Lamps, Ltd. ..	43	C	3
Plessey Co., Ltd.	27	D	3
Prism Manufacturing Co. ..	80	A	2
Primographic Co., Ltd. ..	223	E	4
Primus Manufacturing Co. ..	1A	C	4
Pye Radio, Ltd.	48	C	3
RADIO Gramophone Development Co., Ltd.	56	B	3
Radiometers, Ltd.	203	H	4
Radio Resistor Co., Ltd. ..	16	D	1
Radio Society of Great Britain	214	F	4
Radio Wholesalers Federation	T1	H	4
Rawlplug Co., Ltd.	79	A	2
Reproducers & Amplifiers, Ltd.	92	C	1
Rists Wires & Cables, Ltd. ..	208	G	4
Rothermel, R. A., Ltd. ..	89	C	1
SELECTA Gramophones, Ltd.	T11	H	2
Self Changing Gramophones, Ltd.	59	B	4
Shaftesbury Microphones, Ltd.	99	A	1
Siemens Electric Lamps & Supplies, Ltd.	60	B	4
Sound Sales, Ltd.	76	A	3
Stratton & Co., Ltd.	23	D	2
TANNOY Products	45	C	4
Telegraph Condenser Co., Ltd.	68	A	1
362 Radio Valve Co., Ltd. ..	207	H	4
Tucker Eyelet Co., Ltd. ..	105	A	3
Thompson Diamond & Butcher	T4	H	3
ULTRA Electric, Ltd. ..	52	C	1
Union Radio Co.	20	D	1
VARLEY	77	A	2
Vidor, Ltd.	61	B	4
WATERHOUSE, Frederick, Ltd.	201	H	4
Webber, J. M., & Co., Ltd. ..	T13	H	1
Westinghouse Brake & Signal Co., Ltd.	36	D	2
Weston Electrical Instrument Co., Ltd.	215	F	4
Whiteley Electrical Radio Co., Ltd.	66	B	1
Wharfedale Wireless Works .	204	H	4
Wingrove & Rogers, Ltd. ..	97	B	1
" Wireless Trader, The " ..	T26	E	4
" Wireless World, The" ..	7	D	4
Wright & Weaire, Ltd. ..	95	B	1

Recent Inventions

The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

SCANNING SYSTEMS

ALTHOUGH it is usual, on the score of economy in power, to use electrostatic methods of scanning in a cathode-ray tube television-receiver, the use of magnetic control is stated to give a better focusing of the spot on the screen, particularly for wide angles of deflection.

In order to use the latter method, and at the same time to keep the coil dimensions and applied voltage as small as possible, the high-frequency line-scanning impulses are applied through coils having powdered-iron cores, whilst the lower-frequency frame-scanning impulses are applied through air-cored coils.

C. Lorenz. Akt. Convention date (Germany) July 30th, 1934. No. 445665.

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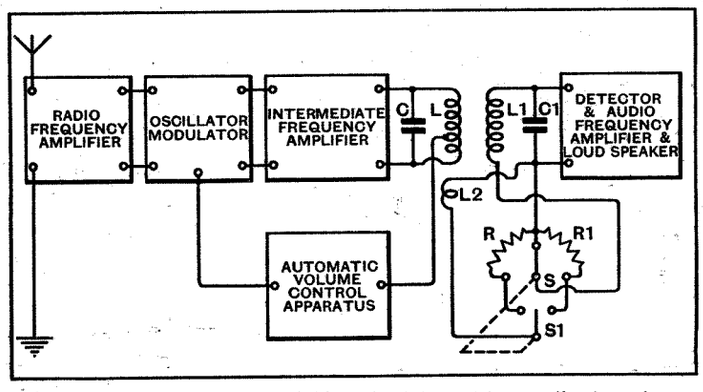
VARIABLE SELECTIVITY

THE selectivity response of a superhet circuit is varied by means of an adjustable coupling inserted between the IF stage and the second detector. The arrangement is designed to give variable selectivity without affecting the overall gain of the receiver.

As shown, the output circuit LC of the IF amplifier is coupled through a similarly-tuned circuit L1, C1 to the input of the detector stage. Associated with the circuit L1, C1 is an additional coupling-coil L2 and a potentiometer R, R1 with two ganged switches S, S1. In the position shown, the selectivity of the coupling is sharp, but the width of side-band passed is narrow, and the fidelity correspondingly low. To increase the quality of reproduction, the switch arm S, S1 is moved to the left. This cuts out some of the resistance R shunting the auxiliary coil L2, thereby increasing the coupling. At the same time, the resistance in the secondary circuit L1, C1 is increased by the addition of that part of the resistance R to the right of the switch arm. The extra gain introduced by the coil L2 is thus counterbalanced by a certain damping due to the added resistance.

Hazeltine Corporation (assignees of J. K. Johnson). Convention date (U.S.A.) May 22nd, 1934. No. 445922.

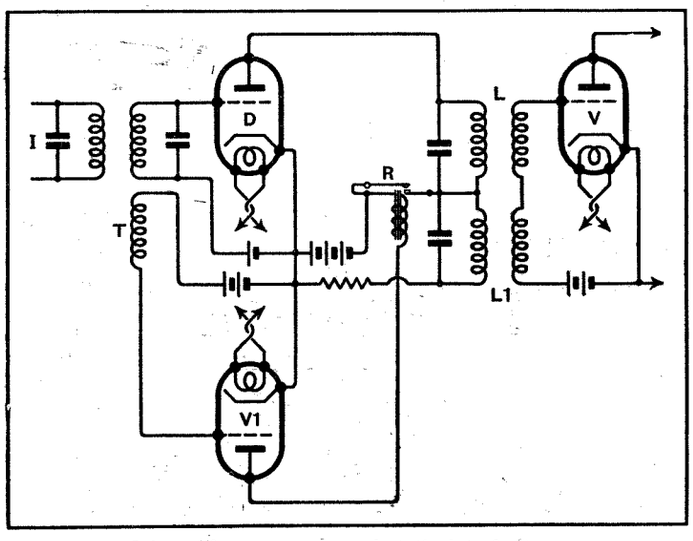


Method for obtaining variable selectivity without affecting the amplification of the set.

ELIMINATING STATIC DISTURBANCES

THE arrival of a static impulse automatically opens a switch which prevents the disturbance from getting through to the loudspeaker. If the time-period of the disturbance, as is usually the case, is less than the 1/25th of a second, the momentary short-circuiting of the loudspeaker does not sensibly affect the continuity of the received programme, though it effectively gets rid of the interference.

As shown in the drawing, an auxiliary valve V1 is coupled at T to the aerial or other input I. The normal path of the signal is through the rectifier D and low-frequency amplifier V. If, however, a strong static impulse is received, it "triggers" the auxiliary valve V (which operates as an anode-bend rectifier) and the resulting current operates a relay R, which momentarily breaks the HT supply to the anode of the rectifier D. This stops both the signal and disturbance from passing through to the LF amplifier V and so short-circuits the loudspeaker. As soon as the impulse has passed, the relay R is automatically reset and the circuits are restored to normal.



Scheme for suppression of static interference.

The sudden interruption of the anode circuit of the rectifier D would normally produce a sudden surge of current in the coupling L. This is neutralised so far as any effect on the LF valve V is concerned by a second coupling L1, which produces an equal but opposite surge.

N. V. Philips Gloeilampen Fabrieken. Convention date (Germany) February 1st, 1935. No. 445763.

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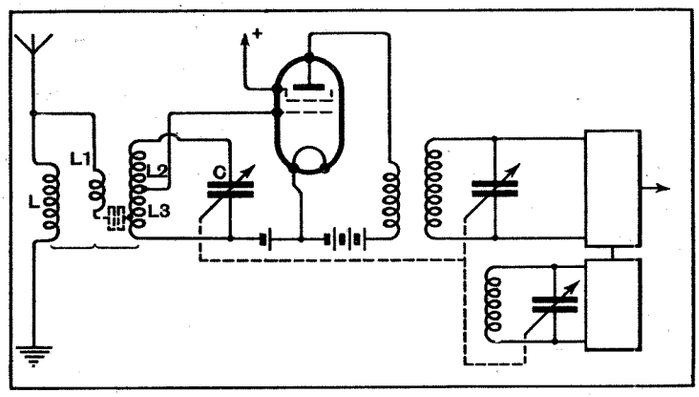
IMAGE SUPPRESSION

TO cut out the so-called "image" frequencies from a superhet receiver, particularly where a band-pass input circuit is employed, a high-impedance input coil L, provided with an open-ended auxiliary coil L1, is wound on the same former as the secondary coil L2, L3 in such a way as to give the combined inductive and capacity coupling necessary for the band-pass effect. The primary coil L is coupled magnetically only with the lower or earthed end L3 of the secondary winding, the auxiliary coil L1 providing the capacity coupling. The secondary winding is tapped, as shown, to the grid of the first valve. Image suppression takes place across the series circuit formed by the part L2 of the secondary coil and the tuning-condenser C. Any source of disturbance in the coil L3 will induce equal and opposite voltages across L2 and C, and therefore feeds a minimum of image interference to the valve.



Circuit for image signal suppression in a superheterodyne receiver.

Marconi's Wireless Telegraph Co., Ld. (assignees of J. Yolles). Convention date (U.S.A.) October 28th, 1933. No. 446018.

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DRY-CONTACT RECTIFIERS

AN electro-positive electrode of magnesium is combined with an electro-negative electrode of copper sulphide, and a non-polarising element of carbonised nickel.

S. Ruben (assignor to Ruben Rectifier Corporation). No. 2032439. (U.S.A.).

o o o o

"DEFLECTION" VALVES

THE electron stream is first concentrated into a beam by a perforated screen placed close to the filament. It is then forced to take a curved path through the valve, the direction of which constantly changes, so the stream is diverted first to one and then to the other of two distant anodes. The resulting interruption of the discharge stream produces oscillations of very high frequency.

G. F. Brett (assignor to Radio Corporation of America. No. 2027017. (U.S.A.)

o o o o

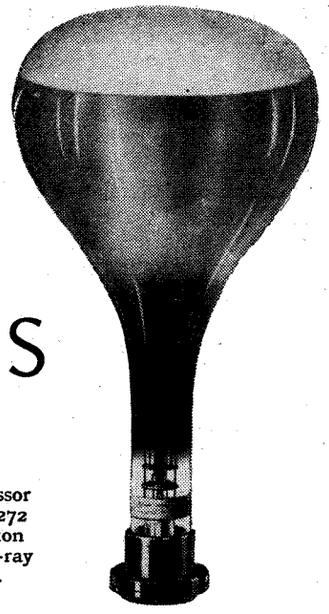
VARIABLE-CAPACITY VALVES

TWO electrodes are spaced apart in a gas-filled tube, and one is given a negative bias which serves to collect a "sheath" of positive ions. A positive voltage applied to the other electrode then regulates the ionization of the contained gas, so that the tube as a whole forms a capacity the value of which can be controlled by the applied potentials. The device is used as a variable tuning control, or as a variable capacitance generally.

I. Langmuir (assignor to General Electric Co.). No. 2032620. (U.S.A.)

Television and Cathode-Ray Apparatus

RECEIVING EQUIPMENT
TUBES AND
OSCILLOGRAPHS



The Cossor Type 3272 television cathode-ray tube.

ONE of the features which will make this year's exhibition outstanding is the prominence which will be given to television apparatus. Television receivers have previously been shown, it is true, but never before has equipment for high-definition television been shown by so many firms. It is, of course, early days in television as yet, and at the time of writing vision from the Alexandra Palace has not passed the stage of initial tests. This has not deterred research laboratories from developing receivers, however, so that it is to be anticipated that the start of a vision service will not find receivers far behind.

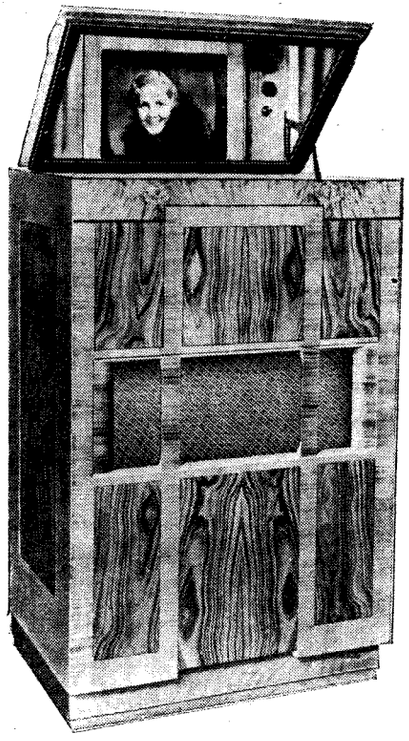
Two different models will be shown by Marconiphone, but the same vision equipment is used in each. The vision receiver is not a superheterodyne but a straight set embodying five stages of HF amplification, giving a total amplification of some 40,000 times. The circuits are pretuned to 45 Mc/s and the output is taken to a diode detector which feeds the vision signals to the cathode-ray tube and the synchronising impulses to the time-bases. Two valve-oscillators are employed in this portion of the equipment and generate the necessary scanning voltages for actuating the cathode-ray tube. A special power unit for supplying the necessary operating voltages completes the vision receiver.

In the model 701 a picture of 10in. × 8in. is obtained; it is not viewed directly but through an inclined mirror, for the cathode-ray tube is mounted vertically. For sound reception, an all-wave receiver covering 16.7-53, 46-140, 185-560, and 750-2,250 metres, and having an output of 3 watts, is fitted. In order to receive the sound accompaniment to television on 41.5 Mc/s this receiver is employed and derives its input from the second stage of the vision receiver.

The model 702 has the same vision equipment, but the picture size is 9½in. by 8in.; as in the 701, it is viewed through a mirror. The sound receiver in this model is intended purely for ultra-short-wave reception, and like the vision receiver is fixed tuned, but to 41.5 Mc/s instead of 45 Mc/s. It is a superheterodyne having a triode-hexode frequency-changer, one IF stage, a duo-diode-triode detector and LF amplifier and a pentode output valve.

Aerial equipment for ultra-short-wave reception is supplied with the receivers, and consists of wires cut to the correct length for a half-wave dipole, the necessary insulators, and a special screened cable for the connection to the receiver. Where the distance between the receiver and the aerial does not exceed some 50ft. lead-covered bell-wire can be used for the connection, but at greater separations a special high-frequency feeder cable is necessary. The same aerial is used for both sound and vision on ultra-short wavelengths, but in the case of the model 701 an ordinary aerial is required in addition for receiving on the longer wavelengths.

Two vision and sound receivers will be shown by H.M.V. In the case of the



The Marconiphone Model 702 ultra-short-wave vision and sound receiver.

Model 900 the sound receiver is an all-wave set covering 7-141 metres continuously in three ranges and 185-560 metres and 750-2,200 metres. The output stage delivers some 3 watts to the loud speaker and six valves are used in this portion of the equipment. The vision receiver and synchronising gear have a total of fifteen valves, and there are two more in the power unit. The total number of valves is thus twenty-three. The cathode-ray tube has a diameter of 12in., and is mounted vertically, the picture being viewed through a mirror. The model 901 is similar, but the sound receiver is for ultra-short waves only; both sets are pretuned and the total number of valves is twenty-two, there being four in the sound receiver.

The G.E.C. will also be showing television equipment, and it is understood that in this apparatus the tube is mounted horizontally and viewed directly. This course is adopted in the Cossor apparatus, which has a cathode-ray tube having a diameter of about 13in. A superheterodyne is used for both vision and sound, and the sound receiver also functions on the medium and long wavebands, so that ordinary broadcasting can be enjoyed. The "Televisor" shown on the Bush Radio stand is also a superheterodyne employing a total of twenty valves. The cathode-ray tube is mounted vertically and covered by a sheet of safety glass; the picture, which has a size of 12in. by 9in., is viewed through a mirror.

CATHODE-RAY TUBES

All receivers, whatever their make, are arranged for reception of either the 240 lines 25 frames of the Baird transmissions or the 405 interlaced lines 50 half-frames of the E.M.I. system, the change being accomplished by means of a switch. In addition to the ordinary controls of the sound apparatus, the vision equipment is provided with brilliancy, contrast, and synchronising controls.

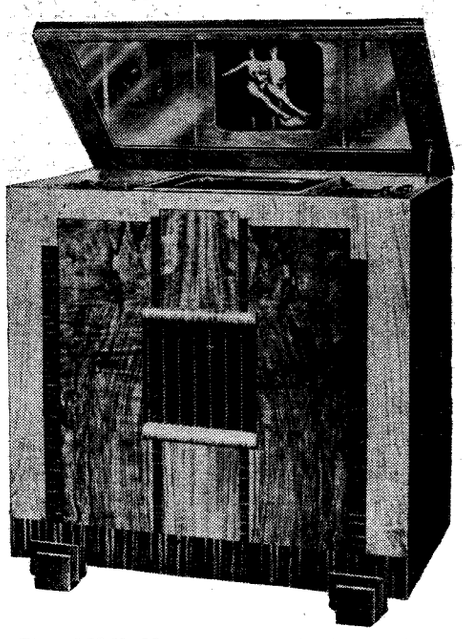
In addition to complete apparatus, much subsidiary gear will be shown, chief among which are cathode-ray tubes. As well as their well-known older tubes,

Television and Cathode-Ray Apparatus—
Ediswan will have a new cathode-ray tube for television purposes. This is the type 12H with a screen diameter of 30 cms. It has a heater consuming 1.5 ampere at 2 volts AC or DC, and its maximum anode potential is 6,000 volts. Under normal operating conditions the 3rd anode requires 4,000 volts, the 2nd 1,200 volts, and the 1st 150-400 volts, while about 100-250 volts grid bias is needed. The maximum modulating voltage required is 20 volts peak to peak.

Cossor have a wide range of tubes, the largest being the type 3272 with a diameter of 34 cms. and requiring 4,500 volts for its operation. It is of the three-anode type, has a black-and-white screen, and costs 15 guineas. A smaller tube, the 3274, requires the same voltage and has a diameter of 25.4 cms.; it is priced at 12 guineas. This firm will also have a tube for television transmission and high-speed photography with a diameter of 13.3 cms.; it requires 10,000 volts.

The Mullard 42-12 television tube has a diameter of 30 cms. and requires 3,000-5,000 volts for the third anode with a potential of 650-1,000 volts for the second anode. The first anode needs only 250 volts with about 80 volts grid bias. The heater is rated at 4 volts 1 ampere, and the tube has a white screen.

In addition to television tubes, there will be many smaller cathode-ray tubes on view which are intended primarily for oscillographic purposes, although some of them can be used for television also. The Mullard 6001 tube is of this type; its operating conditions are similar to those of the 42-12, but it has a diameter of 22 cms. and a green screen. Smaller tubes



The H.M.V. Model 900 combined television and all-wave sound receiver.

are the 42-G6 and 42-B6 with green and blue screens respectively. They have a diameter of 16 cms. and are of the two-anode type requiring a maximum operating potential of 2,000 volts. A tube of purely oscillographic interest is the 4002, which needs only 1,000 volts. It has two anodes, a green screen, and a diameter of 9.5 cms.

The Cossor general-purpose high-vacuum tube is the 3276, with a diameter of 16.2 cms. It has three anodes and needs up to 4,000 volts; the screen is blue with an afterglow of less than 1μsec., but it is also available with a sepia screen. It is priced at 8 guineas. Gas-focused tubes will

The new Mullard television cathode-ray tube.

also be shown, including the 3237, which has a diameter of 4½in., requires 1,500 volts, and costs £4 15s.

Osram will be showing gas-filled relays which in the smaller types find application in television and other time-bases. The GT1 is an example of these. It is indirectly heated, has a control ratio of about 20, and is rated for a maximum anode current of 0.5 ampere RMS. It is priced at 40s. Ediswan will also have relays of this type on view under the trade name of Thyratron.

Among apparatus for use in conjunction with cathode-ray tubes must be mentioned the Haynes Radio time-base units. These are available in various forms, and one of them is a double time-base suitable for television purposes. It includes gas-filled relays, and an output of up to 1,000 volts is obtainable in push-pull. High-voltage mains units with outputs up to 5,000 volts for operating cathode-ray tubes will also be shown.

Cossor will have a time-base, using hard valves and with a frequency range of ¼ c/s to 250 kc/s and push-pull output. Power units for operating CR tubes will also be shown by both these firms.

Complete cathode-ray gear will also be shown by Cossor, including a linear oscillograph with a built-in time-base and mains unit. For use in conjunction with this, there will also be a special ganging oscillator. This is in the form of a signal generator with a frequency-range of 90 kc/s to 20 Mc/s and capable of being amplitude modulated at 400 c/s or by an external source. In addition, frequency modulation of ±15 kc/s is obtainable so that a picture of the resonance curve of the receiver under test can be seen in the cathode-ray tube. Other apparatus includes an engine indicator and a cardiograph.

Notes and News

Weather Forecasts Unwanted

FRENCH hoteliers and others engaged in the holiday trade are said to have written to their respective associations asking them to make strong representations to the broadcasting authorities against the transmission of wireless weather reports. They complain that in many cases these are unduly pessimistic, and are not fulfilled, with the result that considerable trade is lost owing to holiday-makers deciding to remain at home.

High-powered Stations for Greece

FOR a long time past one of the few countries possessing a properly organised broadcasting service has been Greece. It is reported, however, that this deficiency is to be remedied by the installation of a 100-kilowatt station in Athens, and by installations of somewhat smaller power in Salonica and Corfu.

Noted French Journalist Dead

WE regret to announce the death of Dr. Pierre Corret, one of the pioneer French radio journalists. It was Dr. Corret who first drew public attention to Branly's experiments with the coherer by a series of articles in *La Croix*. These articles were afterwards collected together into a volume, this being the first book published in France which dealt with radio. Although serving as medical officer during the War he did not cease his wireless activities, but continued his experiments with crystal and electrolytic detectors, and, later, with valves. After the War he was one of the first amateur transmitters to investigate the possibilities of short waves, and became known as the Father of French amateur radio.

More Broadcasts from Ireland

IN view of the overwhelming demand for later programmes, it is probable that in the autumn the transmission time of the Irish stations will be extended until midnight each evening. For the most part this extra programme time will consist of dance music, although it is rumoured that Lieutenant James Doyle, who has recently been appointed as the first full-time conductor of the radio orchestra, has some special plans up his sleeve.

German Television Progress

ARRANGEMENTS are being made to give television demonstrations of a special type during the German wireless exhibition, which will be held from August 28th to September 6th. These demonstrations are to operate on 380 lines.

Foreign Listeners

THE number of Scandinavian listeners is steadily increasing, the figures for Norway, Sweden and Denmark being 213,481, 843,413, and 607,184 respectively. In Germany, where licences are issued on a monthly basis, the customary holiday-time decrease in the number of listeners has been partly checked by the Olympic Games. Germany now has 7,404,144 listeners. The latest figures for Great Britain show an increase during the past year of 572,228, bringing the total up to 7,718,557.

Polytechnic Wireless Course

IT is often said that those engaged in the various branches of wireless work lack opportunity for extending their knowledge of theory, but in actual fact this is not so, for more than one educational institution provides appropriate courses of study nowadays. Among these is the Regent Street Polytechnic, which conducts an evening-class course in wireless and high-frequency engineering, including television. The course gives a thorough training in theory and also in practical work, and is especially suitable for those engaged in wireless, television of talking film spheres. A special class is also held for radio dealers. The session commences on September 28th, and full particulars will be supplied on application to the Polytechnic, 207-311, Regent Street, W.1.

The Wireless World

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

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EDITORIAL COMMENT

Television is Here

Demonstrations at Olympia

THE first public demonstrations of high-definition television in this country are being given to visitors to the Radio Exhibition at Olympia. The transmissions are being conducted from the Alexandra Palace by arrangement with the B.B.C., but it is emphasised that at the moment these broadcasts are of an experimental nature. Those responsible for the transmissions have been very hard at work during the last few weeks in the endeavour to get ready in time to give these first demonstrations at such an opportune time as the Olympia Radio Show.

The demonstrations are being given twice daily during the period of the Exhibition, from 12 noon to 1.30 p.m., and from 4.30 until 6 p.m., and commence with transmissions by the Baird system on the opening day of the Show, after which the E.M.I.-Marconi and Baird systems will alternate. On another page in this issue some photographs and a general description of the arrangements at the Alexandra Palace are included, so as to give readers some impressions of "the other side of the picture."

Technical details of the transmitting equipment of the Baird Company and Marconi-E.M.I. are to be available for publication, and we hope to be able to describe these systems for the benefit of our readers in an early issue.

Visitors to the Show will also have the opportunity of inspecting a selection of modern television receivers, which will be on view on several stands, but they will not, of course, be demonstrated on the stands, nor will they be on sale. The date when television sets will first be for sale will, we understand, depend upon how soon the B.B.C. feel satisfied that they can describe the transmissions as a service rather than experimental, but judging from what we have seen it seems likely that the commencement of the service need not be long delayed for technical reasons.

It is very gratifying that the organisers of the Exhibition and the B.B.C. have determined that these demonstrations at Olympia should be the real thing and not something different in conditions of reception and transmission from what the public may expect to receive when the service starts. The public can now form its own opinion and know the worst or the best, whichever view may be taken.

How Will the Public React?

It is certain that a very large proportion of the public will be amazed at the progress which television has made and at the success which has attended the very strenuous efforts of all concerned. It is equally certain that there will be a big section of the public who will register disappointment because they have been over-optimistic or have been led away to think that the accomplishment was even greater than it is by over-enthusiastic reports which have so frequently found their way into print.

The demonstrations at Olympia will serve the very valuable purpose of indicating to the public just where television stands and what is to be expected of it, and we believe that whilst there will be no overwhelming demand for television receivers at the outset, there will be steady buying by those who can afford an expensive instrument, and as these receivers get into the hands of the public they will provide propaganda to encourage others to participate in the enjoyment of the new service.

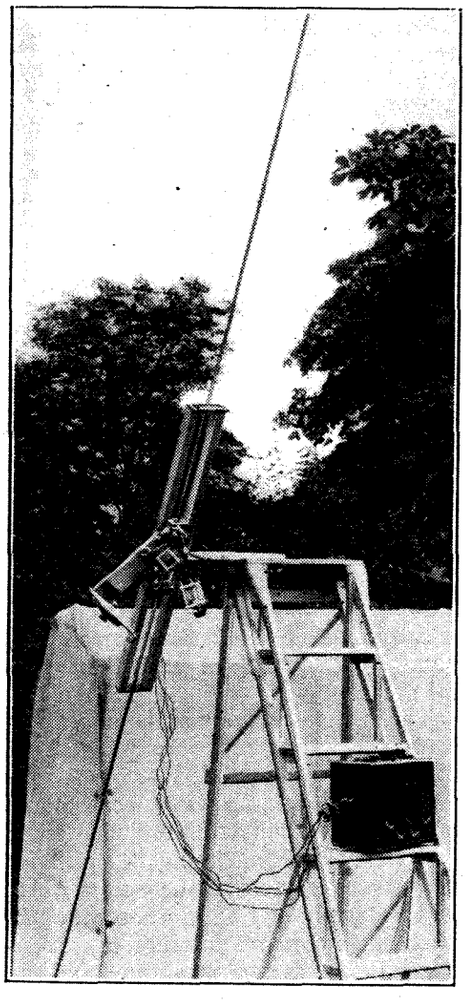
Television

IN this article the author describes results of reception tests of the television and sound transmissions now being sent out from the Alexandra Palace in preparation for the television service. These tests were with a Hertzian dipole aerial, but the author points out that this must not be regarded as necessarily the best or final form of aerial to employ.

NOW that the long-awaited television signals from the Alexandra Palace have actually started, we may expect them to supply the answers to a number of questions that have hitherto been matters for conjecture. What is the effective range? How much interference from car ignition? The effect of the nature and elevation of ground, and intervening buildings? And so on. Ultra-short-wave transmissions of such power and duration have never yet been available, so there may be some surprises.

The design of ultra-short-wave receivers will no doubt continue to bring better and better results within reach; but, already, as with the waves to which we are more accustomed, the problem is not so much one of obtaining enough amplification to bring in the desired signal as of keeping out noise—of which the most serious source that has yet become apparent is ignition.

So far as television is concerned the resources of high selectivity are denied, because of the wide band that must be received. The most obvious line of attack is to take advantage of any difference in direction or polarisation between wanted and unwanted signals. For this reason the subject of aerials is going to be very important indeed in the development of television or any other ultra-short-wave reception.



Temporary erection of a dipole aerial with a frequency changer circuit used in conjunction with a portable receiver, as shown.

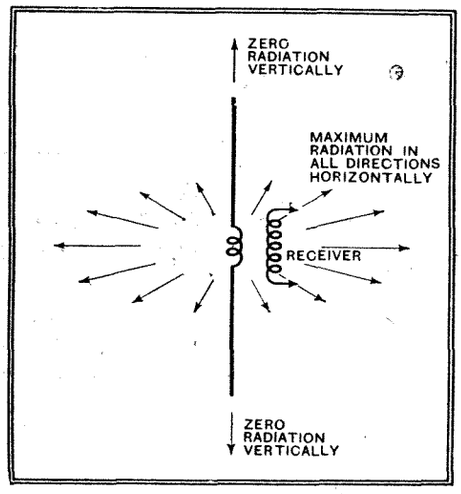


Fig. 1.—Showing a vertical dipole aerial, with the directions of zero and maximum radiation—or reception. Expressed in terrestrial terms, the dipole does nothing in the polar directions, and most all around the equator . . .

You may ask why the foregoing observation should be limited to *ultra-short* waves. It is true that aerial design has provided a welcome expedient for minimising noise interference with ordinary broadcast waves; but the reason why there is exceptional scope on the ultra-shorts is that when the length of the wave is well within the dimensions of the space available for erecting aerials it is practicable to use aerial systems that are naturally resonant to such waves, and which, as a result, offer scope for highly efficient directional characteristics.

Principle of Dipole

The basic form of aerial, from which many of the more elaborate systems are devised, is the Hertzian dipole (Fig. 1), which resonates when its length from end to end is a few per cent. less than half the wavelength. There is no radiation or reception at all in an endwise direction, and there is a maximum in any direction at right angles to it. But it does not follow, because a receiving dipole is at right angles to the direction from which the radiation is coming, that there will be maximum or indeed any reception. I mentioned not only the direction but also the *polarisation* of the waves. This refers to the plane in which the waves are, so to speak, waggling.

Fig. 2 explains this. In the distance is a receiving aerial. If the transmitting aerial in the foreground is pointing towards it, the radiation goes upwards, downwards, sideways, and in any direction at right angles to the proper one, as suggested by the wavy lines. No radiation whatever reaches the receiver.

If the transmitting aerial is tuned through a right angle in the horizontal plane, the vertical plane in which it radiates now includes the receiver; so the *direction* is all right. But there is still no

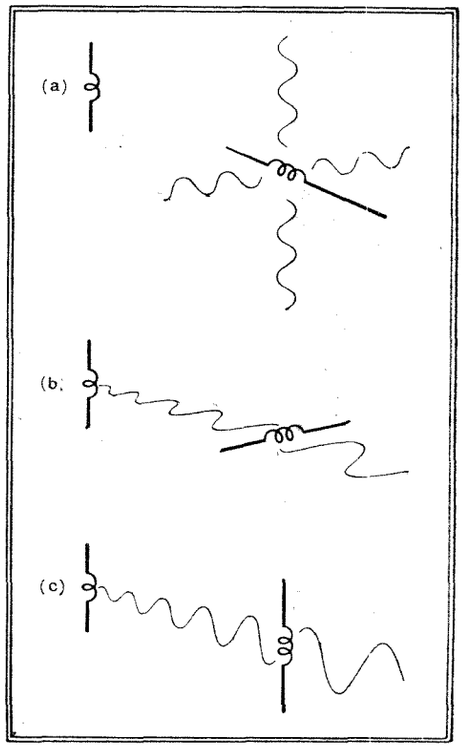


Fig. 2.—. . . consequently if a "pole" of a transmitting aerial points towards a receiving aerial—however arranged—there is no reception (a). The maximum radiation is at right angles. If the receiving aerial is situated on the "equator" (b) it receives maximum radiation, but fails to respond unless the two aerials have a parallel component, of which (c) is the fullest example.

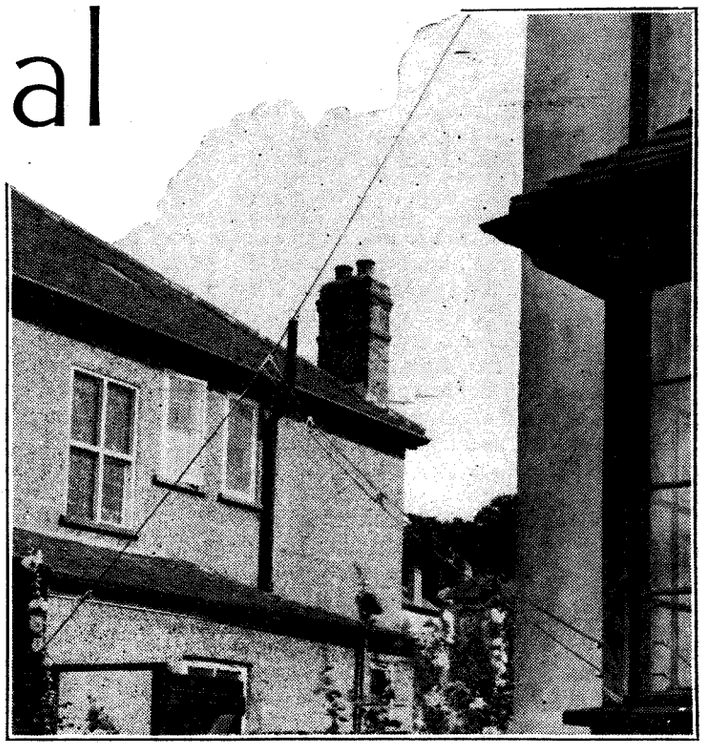
reception. The wave is *horizontally polarised*, and it is necessary for the transmitting aerial to be vertical, as shown at (c), in order to provide a signal that a vertical receiving aerial can utilise. Of course, it is usually a matter of adjusting the receiving aerial to suit a fixed transmitter, but the same principles apply.

In actual practice both direction and polarisation can be, and usually are, affected *en route*. It is well known that

and the Aerial

SOME EXPERIMENTS ON THE ALEXANDRA PALACE SIGNALS

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.



Aerial arrangement with lead-in through a window.

upgoing waves are often turned downwards again by the upper layers of the atmosphere, though this effect in general does not take place below about 10 metres in wavelength. At the same time it is usual to find that waves which were sent off from the transmitting station all waggling in an orderly and regular vertical plane arrive waggling from side to side and in all sorts of directions. If there is no angle at which more waves are waggling than at any other, they are said to be unpolarised, or, more properly, circularly polarised. A receiving aerial would respond equally when set at any angle perpendicular to the direction of the transmitter (or, more correctly, the direction from which the waves are coming, which may not be the same). Generally, however, there is an angle at which reception is a maximum, even when the waves have become considerably disordered on the way.

Tests on Palace Signals

Having refreshed the memory regarding these principles, we can take some interest in the results of actual tests on signals from the Alexandra Palace. The apparatus consisted of a dipole aerial, mounted so that it could be turned in any direction, with a tiny receiver located at the centre to indicate the relative strength of response. With this one can search for the angle at which the greatest proportion of waves is to be found.

A single-valve self-quenched super-regenerative receiver was tried first, but found to be useless as it brought in strong signals with no aerial at all, and owing to its inherent AVC properties it was not possible to judge of changes in field strength.

A simple reaction circuit was next tried, but although the test signals from the Palace were audible they were so weak that adjustment was excessively critical for portable apparatus.

So by a trifling modification the circuit was converted into a frequency-changer to provide, in conjunction with an ordinary portable broadcast receiver, superheterodyne reception. The circuit is shown in Fig. 3; the valve was a "Midget" XD, and the external leads were kept out of the ultra-short-wave part of the system by isolating the circuit with suitable chokes. The anode circuit of the valve was roughly tuned to 2,000 metres; and a lead taken from the "hot" end of it, *via* a small condenser, to the aerial socket of the portable. The valve was fed from the same batteries as the portable which was fitted with a 4-pin socket to facilitate connection to the dipole unit.

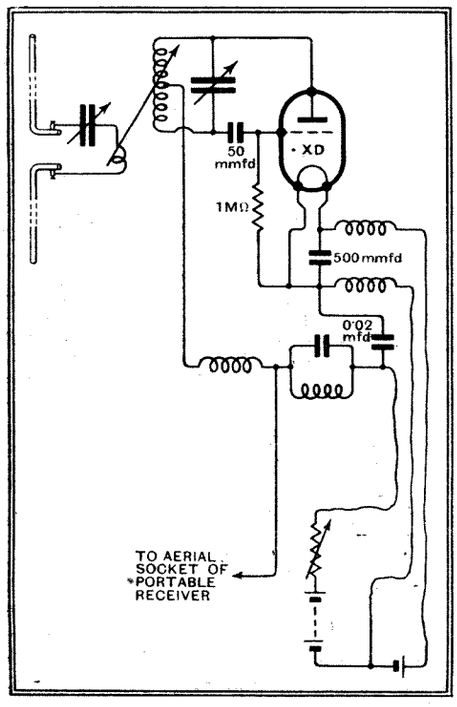


Fig. 3.—Circuit diagram of receiver used in tests described.

The dipole itself was constructed of ⅜in. copper tubes with a total length of just over 10 feet to resonate to about 7 metres when slightly loaded. In the gap at the centre a two-turn coupling coil was mounted in series with a 160 $\mu\mu$F tuning condenser. The tubes could be twisted about their axis so as to swing the coupling coil to or from the oscillator coil to vary the coupling.

Television signals were heard at various times both on the 7.2-metre and the 6.7-metre channels, but chiefly on the latter (which has been tentatively allocated to vision). At the writer's dwelling, which is situated unfavourably (for reception) in a valley between Bromley and Beckenham, fourteen miles in a straight line across the heart of London from the Alexandra Palace, there was a well-defined zero reception with the dipole pointing approximately in the direction of the transmitter and inclined at an angle of about 20 degrees to the horizontal. Whenever tests were made on this site the results always indicated a decidedly downward angle of arrival.

Swinging the dipole in a plane with the former position as axis, to test polarisation, there was no complete zero; the minimum was at an angle of 30 degrees or more to the horizontal, upwards from east to west. The maximum was at right angles to this. Evidently, then, there has been some disturbance of polarisation, and the plane of maximum polarisation has moved through a considerable angle from what presumably was vertical. (At the present stage of activities it is perhaps rather unsafe to make assumptions about this, but the transmitting aerial appears to have been set up for vertical radiation.)

The Ideal Aerial

The moral to be drawn from these results is that, assuming there is no radical change in the type of signal, a vertical aerial is more likely to be satisfactory than a horizontal. A permanent Hertz aerial, erected at an angle for convenience, as shown in the photograph, does happen to come very near optimum as revealed by the foregoing experiments.

To extend the information, the apparatus was taken in a car to some other sites. At a point not far from the first, but practically at the top of a ridge giving a

Television and the Aerial—

distant view, with nearby walls and houses coming just above the horizon in the direction of the transmitter, a decidedly stronger signal was obtained. The direction of the waves was still inclined to the horizontal, but rather less so than before.

At another place, on level open ground about two miles eastward, the angle was practically horizontal, and the plane of maximum polarisation was rotated less from the vertical than at the first site.

It was not practicable in the time available to carry out tests at widely different directions and distances from the transmitter. Previous experience would lead one to expect considerable local variations, but general agreement with the results here described.

Remembering that the object is not only to secure maximum signal but also minimum noise, the dipole was swung near ground level a few yards away from a car with the engine running. Although exceptional engines could be heard over a range of a hundred yards at strength comparable with the television signals, this typical one was less audible at ten yards. There was negligible interference when the dipole was pointing directly towards it; but there seemed to be no predominating polarisation as any position at right angles was about the same. One deduces that for a high signal/noise ratio with a dipole, the best position is as high as possible above the road and pointing directly towards the nearest part of it. This being approximately a vertical setting, and high up, is favourable for signal reception; which would not be the case if interference elimination were sought in this way near ground level.

The simple dipole is very far from being the last word, however, and we may expect to see some systems giving much better discrimination between signal and noise.

Working Below the Ultra Shorts

Electric Wave Propagation Along Copper Tubes

A SYSTEM of "guided-wave" transmission which is neither radio as we know it nor yet ordinary wire transmission, is at present the subject of intense research work by scientists associated with, among others, the Bell Telephone Company, The American Telegraph and Telephone Company and the Massachusetts Institute of Technology. This new system of guided waves commences, so far as wavelength and frequency are concerned, at just about the point where ordinary radio waves leave off, that is to say at about 15 centimetres (2,000 megacycles), and, as is well known, ordinary wireless transmission has not, at present, been conducted on shorter wavelengths than that, so far as commercial work is concerned. Some guided-wave workers are, however, experimenting with wavelengths somewhat greater than 15 centimetres.

Tubular Metal Guides

These guided waves are propagated along hollow metal tubes and, although a great variety of types exist, four are of particular interest. It has been found that in the case of any given type, the diameter of the tube bears a definite relationship to the length of wave which can be propagated. For instance, in the case of a 10-centimetre wavelength, the tube can, so far as one particular type of wave is concerned, have a diameter of 2.30 ins. If, however, the tube is filled with a dielectric having a constant of 5, then a tube of approximately one inch in diameter would suffice, and so on.

Now for three of these types of transmission the attenuation per mile drops to a minimum as the frequency is increased and then slowly rises, and for one of these three the attenuation remains practically constant at this minimum value over a band width of four thousand megacycles. Actually, the variation is less than half a decibel per mile over this band width. The fourth type of transmission is, however, very remarkable insomuch that attenuation appears to become progressively less as the frequency is increased. It happens, however, that this type requires, for a given guide, a higher range of frequency than any other. This puts it, therefore, in a frequency range where it is more difficult to deal with and it is, as a matter of fact, considerably less developed than the others.

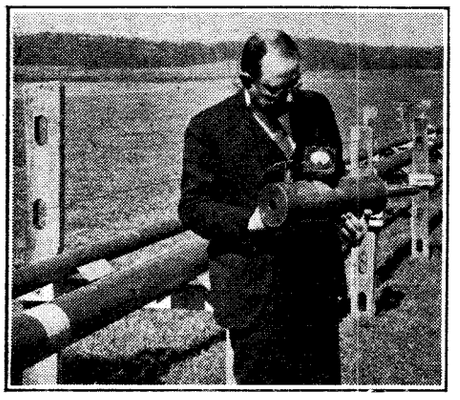
In much the same way that an air column may resonate to certain sound-waves, so may a short section of wave-guide tube be made to resonate electrically to the frequencies which are to be propagated. In its role as a resonator it behaves as does a tuning circuit consisting of coil and con-

Dr. G. C. Southworth, one of the pioneers of "Guided-Wave" transmission, at work with some of the apparatus in the Bell Telephone Laboratories

denser in the case of ordinary radio waves. The necessary energising impulses may be generated by any source of sufficiently high frequency such as a Barkhausen or magnetron oscillator suitably coupled to the resonating chamber according to the particular type of waves being used.

The open end of a conductor may be "flared" and caused to radiate electric wave energy just as the flare of a loudspeaker horn radiates acoustic wave energy. Also it may be arranged in this way to form a highly efficient load for the acoustic generator with which it is associated.

The great question now arises, to what use can this guided-wave system be put? For long-distance work the situation is that it is not yet sufficiently far advanced for any use to be made of it. For transmission over short distances, for use as projectors of electric waves or as selective elements under certain conditions, the wave guides have definite possibilities. The system has also great



In this photograph, two of the copper-tube transmission lines erected by the Bell Telephone Co. can be seen. Dr. G. C. Southworth is seen holding one of the "resonating chambers."

potentialities as a connecting link between the transmitting apparatus and the aerial, or even as the aerial itself in the form of an electro magnetic "horn," such as has been mentioned. The unusual characteristics of the system are well adapted for transmitting the wide-frequency range demanded by television in cases where transmission of television signals has to be carried out from point to point in a city or even, with further development, from city to city. There is, of course, little or no external field and consequently a pleasing absence of interference from radio stations or from external noises.

A NEW BOOK

Modern Radio Communication. Volume II. Second Edition. By J. H. Reyner, B.Sc., A.M.I.E.E. Pp. 220 + xi and 137 illustrations. Price 7s. 6d. net. Sir Isaac Pitman and Sons, Ltd., 39-41, Parker Street, W.C.2.

THIS volume in its second edition has been considerably enlarged and improved by the addition of new material and the rewriting and re-arrangement of some of the text. Some slight errors which appeared in the first editions have been corrected. The book treats the science of radio communication in its more advanced aspects and has been planned to cover the syllabus of the final stage of the City and Guilds examinations.

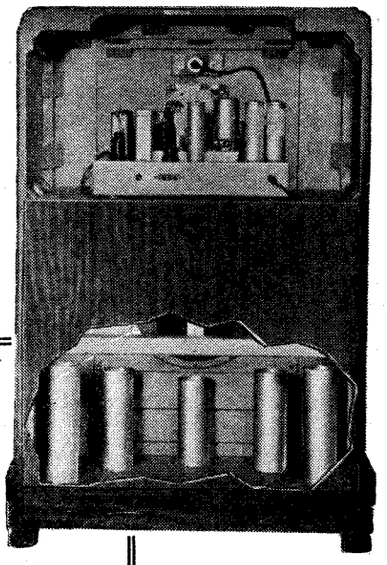
The treatment is concise and clear, lucid explanations of the various circuit reactions being given. Mathematics have been avoided as far as possible and no Calculus is used. Circuit analysis, however, requires a certain amount of mathematical knowledge, and for the benefit of the reader some useful mathematical processes are given in an appendix.

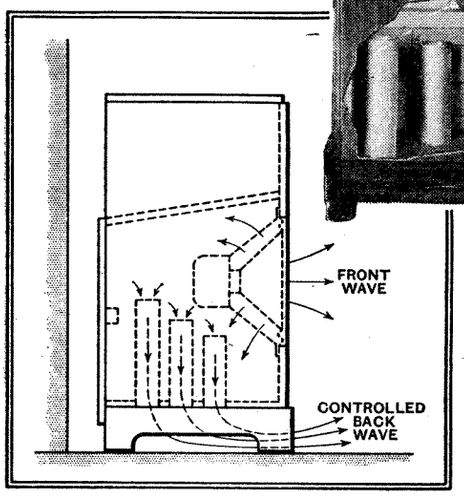
We have no hesitation in recommending the book. O. P.

Cabinet or Baffle?

THE EXTENSION LOUD SPEAKER REVIVES AN OLD PROBLEM

HAVING made the decision to add an extension loud speaker advantage may well be taken of the occasion to try to improve on the quality of reproduction provided by the set. This should not be difficult in the case of conventional cabinet designs





Cabinet resonance is controlled in this RCA receiver by tubes leading out through the base of the instrument.

AS a matter of fact I believe my extension loud speaker sounds better than the one in the set. I've a good mind to have them changed over." One hears this theme, or variations upon it, discussed so frequently that it seems worth while to try to find the cause and, if possible, to indicate a cure for such an apparent anomaly.

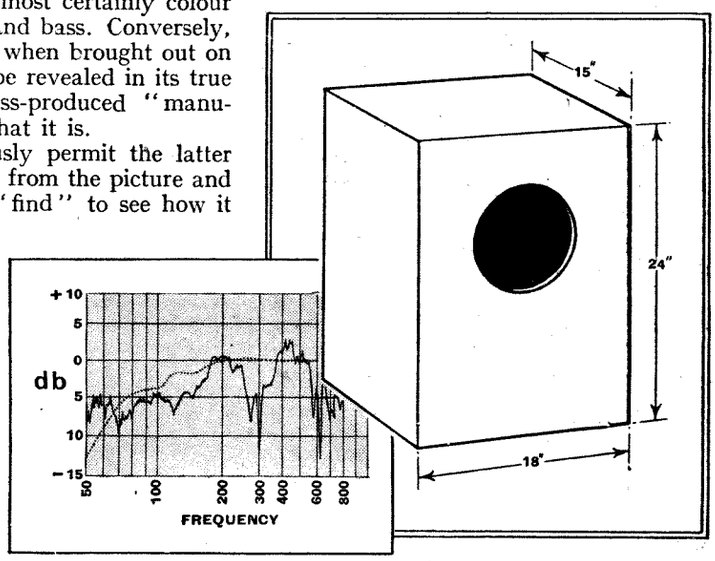
In the first place it is a somewhat chastening thought for the manufacturers that the quality of reproduction they have provided can be improved upon in so casual a manner; but by this time they are no doubt sufficiently thick-skinned to ignore the implied disparagement. Secondly, it seems probable that our friend is about to forfeit the improvement in quality which he has so providentially discovered.

Let us assume that the extension unit which he has bought is in chassis form and has been temporarily installed on a flat baffle to see how it works. Transferring this unit into a radio cabinet of the ordinary sort will almost certainly colour the middle register and bass. Conversely, the set loud speaker when brought out on to a flat baffle will be revealed in its true colours for the mass-produced "manufacturer's model" that it is.

We will chivalrously permit the latter speaker to disappear from the picture and return to our new "find" to see how it is behaving in its new habitat. The principal changes of quality will be most noticeable in the reading of news bulletins, since the important frequencies in the male speaking voice occur at a part of the frequency spectrum which is most affected by cabinet resonances. There will also be in all probability an obtrusively fine foundation of bass in the orchestra. Good bass reproduction, by the way, has to be listened for and never draws attention to itself. The series of resonances which his given rise to this peculiarly irritating form of distortion may be due either to vibration of the sides of the cabinet or to the enclosed body of air itself. These resonances are usually accompanied by troughs which have the effect of throwing the resonances into even greater prominence. As a result the very sensitive region from 500 cycles downwards is severely cut up, and if the evidence of the ear is not sufficient and further proof is required the accompanying curve may be consulted.

The dotted line shows the output from a good quality loud speaker tested on a flat baffle having an area of approximately 22 sq. ft.—in fact, the baffle which is used for taking response curves of loud speakers in connection with *The Wireless World* laboratory tests.

The full line curve shows the output from the same loud speaker when installed in a cabinet of the dimensions shown and constructed of $\frac{3}{8}$in. plywood. Although this cabinet was made without any highly polished veneer, it might otherwise be regarded as representative of some of the larger table model wireless receivers. Smaller cabinets undoubtedly give less apparent disturbance of the loud speaker output for the reason that the ratio of the thickness of the wood to the size of the cabinet is higher and a more rigid structure results. Further, any resonances which may remain are of higher pitch and above the sensitive middle register. On the other hand, of course, the small cabinet gives no bass whatever.



Measured response curves showing the effect of a conventional table model cabinet on the output below 500 cycles. The dotted curve is of the same loud speaker taken on a flat baffle.

Wood Vibration

Most of the irregularities shown in the curve of the larger cabinet are due to wood vibration, and the amplitude developed by the sides of the box at times exceeds that of the loud speaker diaphragm itself. Expense is the only obstacle to the obvious cure for this part of the trouble, namely, heavier construction throughout.

Any irregularities remaining after the cabinet has been given a sufficiently heavy construction must be due to cavity resonance where the mass and elasticity of the air itself are the controlling forces, just as they are in an organ pipe. There are three methods of overcoming this difficulty.

(1) Elimination.

This involves making things difficult for the mass and elasticity to get together at any one particular frequency, and an excellent example of this is to be found in one of the Murphy radio-gramophone cabinets in which the width of the sides gradually diminishes from top to bottom. It is a fact that air resonances favour air volumes of simple geometric form and for this reason any solution under this head-

Cabinet or Baffle?—

ing must inevitably produce a design of somewhat unconventional appearance.

(2) Absorption.

In America the use of subsidiary cavities of the Helmholtz resonator type, or even tuned diaphragms let into the sides of the cabinet at strategic points have been tried as a means of "absorbing" the principal resonance or resonances. Actually they introduce equal and opposite resonances and it is conceivable that under manufacturing conditions difficulties may be experienced in effecting exact neutralisation.

(3) Utilisation.

We may accept the cavity resonance and so modify it that it actually effects an improvement in the loud speaker response. An example of this method is to be found in the RCA console receiver, a recent American product.

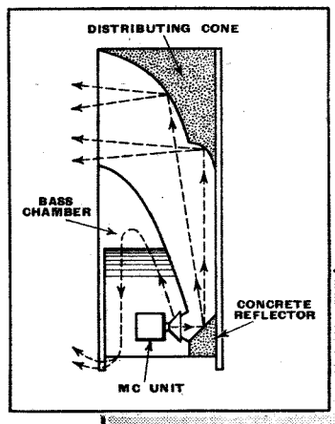
Controlled Resonance

The first step towards scientific control must be to enclose the back of the cabinet with a rigid panel so that the volume and shape of the air column is first of all clearly defined. In the case of open-backed cabinets there is a variable factor due to the distance of the cabinet from the wall. Then in the RCA instrument a series of tubes of varying length and diameter have been introduced into the base of the cabinet. The air in these tubes has mass, which is equivalent to electrical inductance, and also viscosity, which is the equivalent of electrical resistance. These properties can be combined with the elasticity of the air in the main chamber, which may be regarded as the equivalent of electrical capacity, to place the resonance at any desired frequency and also to control its magnitude.

In the Murphy A30 radio-gramophone cabinet the sides are tapered to give a cavity shape which is not prone to any single resonance.

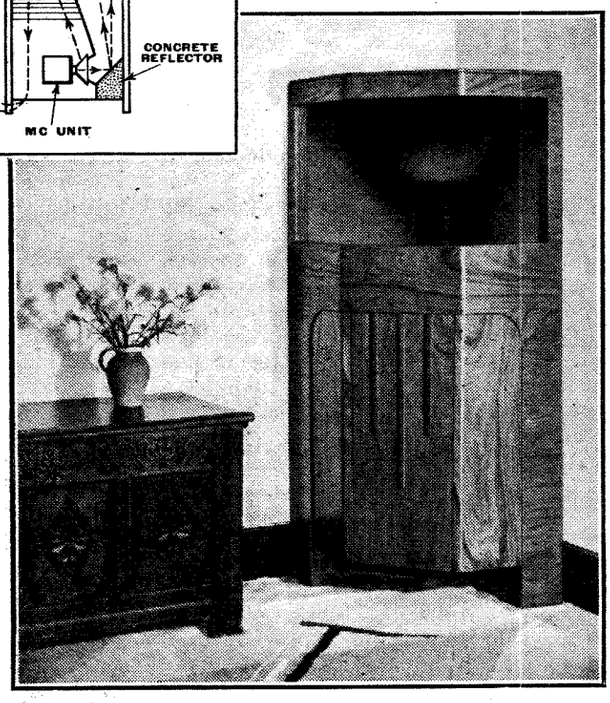
Further, it is possible to arrange that the phase of the wave radiated through the tubes at the bottom of the cabinet shall reinforce the sound wave from the front of the loud speaker diaphragm.

The same principle underlies the "bass chamber" in the Voigt Corner Horn loud speaker, which was described in our issue of December 28th, 1934. Here, however, it is not a case of making the best of something you cannot get rid of, but is a deliberate addition to improve the quality of reproduction.



The Voigt Corner Horn in which a subsidiary air column resonance has been deliberately added to improve the reproduction in the extreme bass.

This speaker might be regarded as the extension loud speaker manufacturer's revenge, for the purchaser is faced with the problem of finding and housing a set to work it. The problem of where to place it in the room is also conveniently solved as it appropriates the walls as an extension of the horn flare. The best position for the set, incidentally, is about 12 inches from the armchair!



After all this, where do we stand? Perhaps we shall see more clearly if we summarise the evidence in a series of axioms: (1) Most wireless cabinets introduce resonances—and at a very sensitive region of the frequency spectrum. (2) It is possible to design a cabinet which is neutral or even beneficial from an acoustic point of view. (3) If your cabinet is not of the latter type, a quality extension loud speaker mounted on a rigid flat baffle is almost certain to give an improvement in quality.

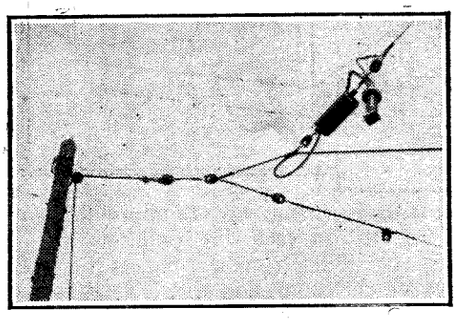


Photo: C. W. Thompson & Co., Murphy Agents, East Sheen.

STRUCK BY LIGHTNING.—This photograph would suggest that anti-interference aerials tend, if anything, to reduce the lightning risk. Although the Belling-Lee Rejectostat transformer was blown out of its screening case the installation was undamaged.

THE RADIO INDUSTRY

FOR the present season all Hartley-Turner energised speakers are to be fitted with the Duode Voice Coil, but retain the characteristic Hartley-Turner features; the DC and AC models cost £6 and £7 respectively. Prices of the permanent-magnet speakers have been reduced.

A tone-corrected superhet receiver (in place of the discontinued M12), new radio-gramophones, and an improved GA12S amplifier have been introduced, while the S12A receiver chassis, available as a kit or complete, has been modified and refined.

Demonstrations during the show period will be given at Thornbury Road, Isleworth, Middlesex.

The Instrument Department of E. K. Cole, Ltd., Southend-on-Sea, announces the introduction of a microwattmeter for measuring audio-frequency power between 0.5 and 200 microwatts.

◇ ◇ ◇ ◇

A new catalogue issued by F. W. Lechner & Co., Ltd., 61, Spencer Street, London, E.C.1, describes multi-contact rotary switches of various types, wire-wound and carbon potentiometers and rheostats, etc.

◇ ◇ ◇ ◇

U.S. Radio, Ltd., of 138, Southwark Street, London, S.E.1, have been appointed sole distributors of the American Arcturus valves, and can supply both glass and metal types from stock.

◇ ◇ ◇ ◇

Twenty-one new season's models are displayed at the recently opened Philco West End showrooms, 193, Regent Street, London, W.1.

◇ ◇ ◇ ◇

The installation of PA equipment at the new Southampton Central Station was recently carried out by Clifford Lister, Ltd., of 209, Portswood Road, Southampton. Two amplifiers and eight speakers are used.

◇ ◇ ◇ ◇

No important change has been made to the range of Pifco test meters, as the present instruments have been found to cover all normal requirements. A list is available from P.I.F. Co., Ltd., Pifco House, Shudehill, Manchester.

◇ ◇ ◇ ◇

In last week's issue one of the Marconiphone television receivers was described as being combined with an all-wave radio-gramophone; this was incorrect, as there is no provision for gramophone reproduction.

Local Station Reception

HIGH-QUALITY REPRODUCTION AT SHORT RANGE

By W. T. COCKING

IT is a fact that is becoming more and more widely appreciated that the highest standard of reproduction is only attainable in local reception. Broadcasting stations are too closely spaced in frequency to enable interference-free reception to be maintained on distant transmissions unless quality is sacrificed in some, and usually a considerable, degree. It is, of course, impossible in the academic sense completely to eliminate interference; all that can be done by increasing the selectivity of a receiver is to increase the ratio of strengths of the wanted and unwanted signals at the detector to such a degree that when finally reproduced by the loud speaker the sounds due to the interfering signal are too weak to be audible. The interference has then been eliminated for all practical purposes.

It is not difficult to see that if the bands of frequencies radiated by the different transmitters are all separate and properly spaced so that suitable gaps exist between the bands it is quite possible to avoid interference by providing adequate selectivity in the receiver, and this without any loss of quality. This, however, is an ideal state of affairs which does not exist in modern broadcasting. In actual fact, the bands of frequencies radiated by the different stations overlap and it is not possible to avoid interference under all circumstances without designing the receiver so that it is not only very selective but greatly attenuates the higher musical frequencies.

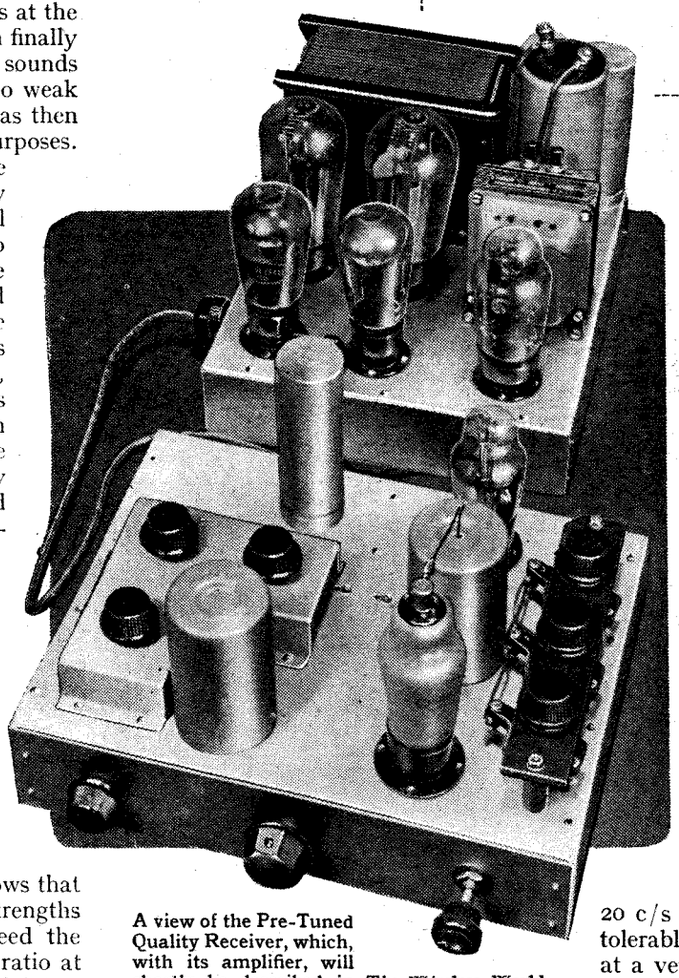
Since the degree of interference experienced depends upon the ratio of the wanted and unwanted signals at the detector it is clear that it also depends upon the ratio of these signals at the aerial, for if the selectivity be constant a change in the latter ratio will alter the former. It follows that the greater the ratio of the signal strengths at the aerial the less selective need the receiver be to maintain a suitable ratio at the detector for the avoidance of interference, and hence the better can be the high-frequency response of the equipment. In practice there is usually only one case in which the wanted signal is so much more powerful than others that interference is automatically avoided without any effort on the part of the receiver. This case is that of local reception, and it is consequently only when receiving such a signal that the full frequency range required for the highest quality can be reproduced.

Some degree of selectivity is, of course, necessary even in local reception, for stations are usually located in pairs. The receiver must, therefore, be sufficiently selective to receive the one station without interference from the other; this is not usually difficult, however, and need entail no sacrifice of quality, for the stations are invariably widely separated in frequency. There are, of course, times and districts in which interference may be experienced in local reception, for the local station may not always prove powerful enough completely to eliminate all audible effects set up by its immediate neighbours in the frequency spectrum—particularly when these neighbours are themselves powerful stations located only a few hundred miles away, when the local is more than ten miles or so from the receiver, and when reception is carried on after darkness has fallen. The interference experienced under these conditions, however, is rarely of a serious order, and consists usually of a weak, high-pitched whistle which it is easy to eliminate at a very small sacrifice in quality.

By the use of a properly designed system of variable selectivity it is possible to make a receiver suitable for both local and distant reception and to obtain on all signals the highest standard of quality that the prevailing interference conditions permit. Such a receiver is undoubtedly the best for general listening, but there are many who require only local reception, and the expense and complication of a large receiver are then unnecessary. Comparatively simple apparatus can be employed, and it is even possible to dispense with the usual tuning control—replacing it by a pre-set tuning system with a change-over switch to permit a few pre-determined stations to be selected.

Experience indicates that the required freedom from distortion and volume level are best provided by means of a push-pull resistance-coupled amplifier. Not only can the response be maintained flat within about 1db. only over the whole range of audible frequencies—some 20 c/s to 20,000 c/s—but the much less tolerable amplitude distortion can be kept at a very low level indeed. The detector need not be a diode, for the grid detector is just as free from distortion when correctly used, and is more convenient and cheaper in many cases. Its great advantage is that it permits the use of reaction. This is not as out of place in a quality receiver as many may suppose; its use is, of course, disadvantageous when the station is strong enough to override inter-

THE attainment of a high standard of reproduction is greatly simplified when only local reception is required, for the receiver, as distinct from the LF amplifier, can usually be of simple design. In this article the factors which must be considered in the design of such equipment are treated in some detail.



A view of the Pre-Tuned Quality Receiver, which, with its amplifier, will shortly be described in *The Wireless World.*

Local Station Reception—

ference, and the control can then be set to zero. When the wanted station is not as strong as this more amplification will usually be needed and is most easily obtained by reaction, for to avoid interference the selectivity will have in any case to be increased and the quality will consequently suffer to some degree.

Even for local reception an HF stage is very desirable, for it eliminates the need for excessive reaction and it permits the equipment's being used on quite a poor or even an indoor aerial. Furthermore, when the aerial is reasonable, it does increase the range of the set somewhat beyond the purely local.

Three-channel Switch-over Set

A receiver designed for reception of this nature will shortly be described in *The Wireless World*; a single HF stage is included and feeds a grid detector which in turn feeds a resistance-coupled push-pull amplifier having an output of some 4-6 watts. Two tuned circuits are included, and the control switch has four positions —three for radio and one for gramophone. A choice of three predetermined stations —two on the medium and one on the long waveband—is thus provided. It is intended that two of the circuits be tuned to the two medium-wave local stations, and that the long-wave circuit be tuned to one of the powerful Continental transmitters, such as Luxembourg, Radio-Paris, or Huizen. The degree of sensitivity and selectivity is sufficient to permit this in most cases when use is made of reaction. In districts having only one medium-wave local station, however, the long-wave circuit will normally be tuned to Droitwich, and the spare medium-wave circuit is then free for some station in this band.

The controls included are only three in number and comprise the station selector switch, the volume control which functions on both radio and gramophone, and the reaction control. For local reception, reaction can usually be left at zero, and it is then only necessary to adjust the volume control in addition to the switch when changing from one station to the other. When reception is required from a more distant transmitter, however, the reaction control may also require some attention.

The complete list of parts necessary for building this equipment will shortly appear in *The Wireless World* and the construction will be described in subsequent issues. In the meantime the completed receiver can be inspected at *The Wireless World* stand at the Olympia Exhibition.

Next Week's Issue

THIRD SPECIAL NUMBER

REVIEW OF THE SHOW

A considered analysis of the season's apparatus based on careful study and comparison of the exhibits by *The Wireless World* technical staff.

Stereoscopic Projection by Polarised Light

Experiments in Manfred von Ardenne's Laboratory

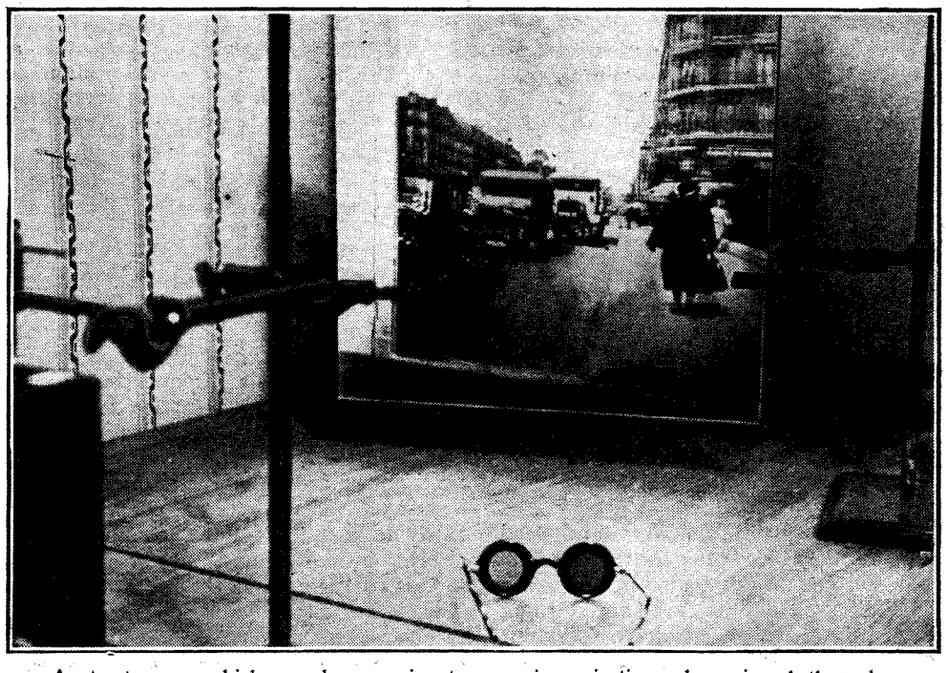
At this year's Conference of the German Society for Photographic Research, in Berlin, a paper was read by Dr. Haase, of Jena, on new polarising filters and their applications. During the subsequent discussion it emerged that more exhaustive tests and measurements on stereoscopic projection, with the help of the new filters, had been carried on in the Manfred von Ardenne Laboratory. At a demonstration at the Lichterfelde laboratory an opportunity was given of seeing the almost startling results given by this solution of the "plastic film" problem. The optical quality of the pictures shown was so good that one felt oneself to be actually standing in the midst of the scene portrayed on the screen.

The idea of obtaining stereoscopic projection by the use of polarised light was, as von Ardenne mentioned at the demonstration, suggested by Anderton a good many years ago. Practical application of the principle, however, failed because at that time there were no suitable polarisers available.

Polarisation Filters

It was not until the appearance of the new "polarisation filters" which have only been on the market a few months that it was possible to produce polarisers in the form of apparently ordinary spectacles, which, however, thanks to the correct orientation of the two "filters" forming the glasses, enable each of the two eyes to pick out only the appropriate image from a composite picture of two images thrown on the screen, each with its light polarised at right angles to the light of the other. Since the image visible to one eye was photographed by a camera situated a little to the right or left of the camera photographing the image visible to the other eye, the effect on the observer is to give a stereoscopic picture. With the old-fashioned stereoscope, where the two pictures were side by side, the eyes were inclined to strain themselves in bringing the two images together. With the present system there is no tiring effect on the eyes, because the two images are merged together on the screen by the projecting apparatus. On removal of the "spectacles," the naked eye sees only one picture (as the photograph shows). This is "flat," with its outlines double.

Completely satisfactory stereoscopic projection, such as was here seen, demands that the state of polarisation of the light should not be changed at the screen. Demonstrations and measurements have shown that this difficulty has been eliminated to such a degree that from all seats of an ordinary cinema the stereoscopic picture can be seen faultlessly.



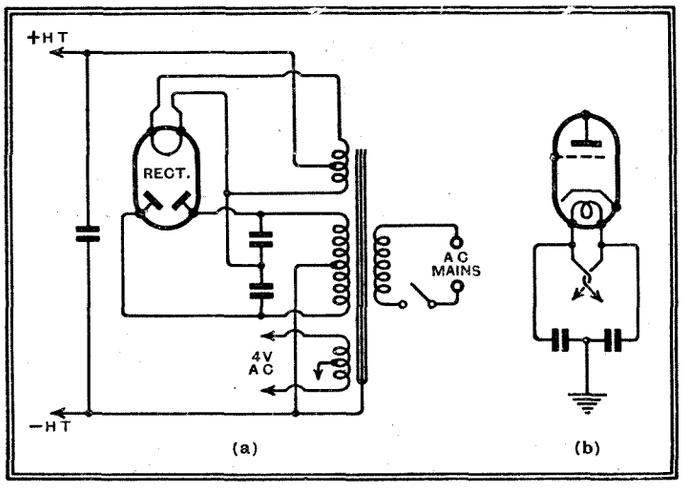
A street scene which can be seen in stereoscopic projection when viewed through polarisation filter spectacles seen in the foreground.

HINTS and TIPS

Practical Aids to Better Reception

BEFORE the widespread adoption of screened primaries for mains transformers a small condenser connected from one side of the mains to earth was usually considered sufficient precaution against modulation hum. Sometimes, however, the mere inclusion of this condenser alone is inadequate, and in such circumstances a complete cure can generally be effected by joining two condensers of 0.001 to 0.005 mfd. in series across the HT secondary winding of the mains transformer.

Modulation Hum



Preventing modulation hum in all-wave sets.

The junction point between these two condensers is normally taken to the centre tap of the rectifier filament winding, but recent experiments with high-gain all-wave receivers have shown that more complete hum elimination can be secured by taking it to one end of the winding, it being immaterial which end is chosen (see Fig. 1 (a)).

A further precaution, which is advisable with short or all-wave sets, is the addition of two condensers of about 0.005 mfd. connected in similar fashion across the heater leads, and with their centre point earthed. They should preferably be mounted as close as possible to the second detector valve-holder (Fig. 1 (b)).

MOST constructors are perfectly aware that the secret of good soldering is to work with the copper bit well and truly tinned, but when the iron is of the non-electric type that requires heating on a flame the difficulty is to keep it so. For as soon as the bit becomes overheated—and it happens inevitably sooner or later—the covering of solder boils off and gives place to an oxide film which firmly refuses to take a fresh application of solder. For this reason tinman's solder should always be used in preference to the resin-cored variety, which on account of its low melting point is only suitable for electric irons.

Tinning the Bit

However, there is fortunately a quicker and more effective way of retinning an overheated bit than filing a new surface. This consists in heating it to red heat and then pressing it firmly into a solid block of sal ammoniac, or a tin containing compressed sal ammoniac crystals. (It is advisable to do this in the open air, if possible, on account of the fumes.) If a few pieces of solder are now dropped immediately into the hollow around the bit it can be readily tinned; after wiping it with a rag until well tinned for about an inch and a half, it should then, whilst still very hot, be plunged into a jar of cold water. This is most important, for it removes the last traces of sal ammoniac which would otherwise be very corrosive.

Another method of keeping the bit always in good usable condition is to have it tinned with silver solder, which has a much higher melting point than ordinary lead solder. Any jeweller will undertake this job for a small sum.

THE behaviour and carrying power of short waves at different times of the day and at different seasons is now fairly well understood, and the matter has been reduced almost to an exact science. It is, however, too involved a matter to be discussed in these notes. To a lesser extent the waves used in normal broadcasting have peculiarities dependent on their length, and it is worth while bearing this in mind when an opportunity exists for obtaining a desired transmission from two or more stations during a simultaneous broadcast.

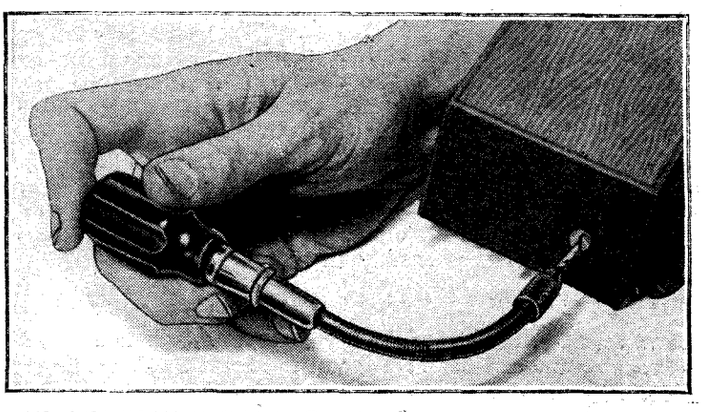
Choosing the Best Wavelength

In general, the shorter broadcasting waves are more liable to absorption or reflection, and thus to the disturbing effect of local screening. The longer waves are more consistent in their behaviour, but when one is depending on "freak" conditions for reception at extreme distances there is less chance of their obtaining the necessary assistance from the reflecting layers of the upper atmosphere.

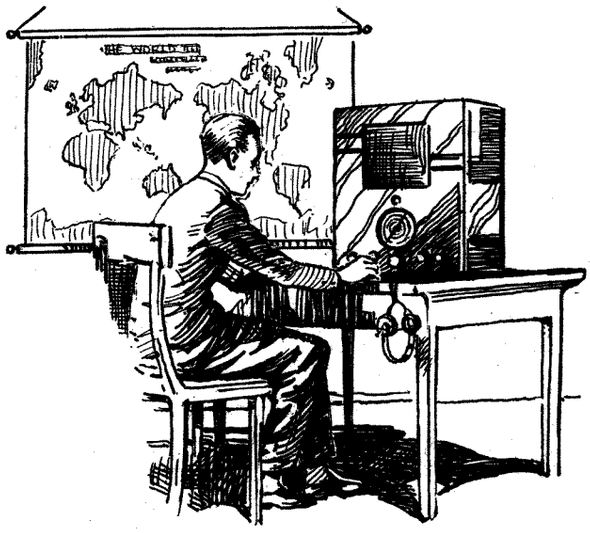
APART from the fact that it is fatally easy to forget the presence of the grid-bias battery altogether, it is useful to remember that battery valves which are no longer in their prime, particularly those of output and screened-grid types, can be persuaded to give a much better performance if their grid bias is reduced well below the maker's recommended figure. Taking, for example, a small power valve of the PM2A or PM22A class, reducing the bias from 4½ to 1½ volts may make a very welcome, if temporary, improvement.

"Reviving" old Valves

In the case of mains valves, it is not, of course, such a simple matter, for the grid bias is invariably obtained automatically by means of resistances hidden away beneath the chassis, and therefore not readily accessible. However, it is usually possible to tell whether a lower value of cathode resistance would effect an improvement, by connecting an external resistance temporarily in parallel with the existing one; the extra resistance should be approximately equal to what is judged, from the type of valve, to be the value of the actual one, and one end should be twisted round the cathode pin of the valve. If, on touching the chassis with the other end, there is a definite increase in signal strength, then there is little doubt that a more permanent connection is warranted. But on no account should the alteration be made a truly permanent part of the chassis wiring, in case its presence should become completely forgotten by the time that the old valve is eventually replaced by a new one.



AN AMERICAN GADGET.—Described as a limber screwdriver for working around corners, this tool has a flexible shaft of laminated steel.



An Introduction to

THE LURE OF THE SHORTER WAVELENGTHS

THERE are probably a number of *Wireless World* readers, especially at "Show" time, to whom all-wave listening is still a novelty and it is for these readers that this article is especially written, although it is hoped that it will be of interest to veteran short-wave fans as well.

The Show has revealed that most of the receivers of this season are of the so-called "All-Wave" type—that is to say, in addition to the medium and long wave ranges of the normal receiver, which enable you to tune from 200-550 metres and from 1,000-2,000 metres, they also possess a third and sometimes even a fourth and fifth tuning range.

On these new receivers a mere flick of a switch will take you down "Below 100 metres" and under favourable conditions enable you to tune in stations up to half-a-world away. Suva VPD, Fiji on 22.94 metres, 13.07 megacycles, and ZLW Wellington, N.Z. on 24.39 metres, 12.3 megacycles are rare catches it is true, but by no means impossible ones even to the layman. The short wave range of the 3-band receiver will generally cover from 16.7 to 50 metres (though in some cases, generally with straight receivers, this range will extend from 19 to 50 metres only) so that Suva and Wellington stations would be tuned in at about one-third the way along the short-wave scale.

Megacycles and Metres

The wise newcomer will, however, first of all confine his attentions to tuning in the powerful European "locals" which operate in the "international short-wave bands" in the vicinity of 17, 19, 25, 31 and 49 metres. The magic figure joining megacycles and metres is 300, divide it by either and you get the other. For example, 25.00 metres is exactly 12 megacycles, $\frac{300}{25}=12$, or $\frac{300}{12}=25$, the shorter the wavelength, the higher the frequency.

Probably the easiest to receive of these "locals" is Berlin (the transmitters are at Zeesen) and in the afternoons very strong signals can usually be heard from DJE (16.89 metres), in the 17-metre or 18-megacycle band; another good signal in this band will be the famous Dutch transmitter PHI, and the most regular but, unfortunately, noticeably weaker signal will be W3XAL, the National Broadcasting Company's station at Bound Brook, N.J. in the U.S.A., which works on 16.87 metres, 17.78 megacycles.

This band also accommodates the Empire Station GSG on 16.86 metres, 17.79 megacycles, which like W3XAL will be best heard in the late afternoon and evenings in September. During the summer months and sometimes late spring and early autumn this band is productive of results until after midnight, although called by some the "daylight band."

Owing to the favourable signal-to-noise ratio which exists below 20 metres, weak signals often possess good entertainment value, but a good, electrically quiet location is required in order to receive W3XAL really satisfactorily.

The tuning knob of the receiver may now be turned to the second prominent marking on the scale; for on most receivers the positions of the "international short-wave bands" are clearly marked, forming a very useful rough tuning guide, this second point being the 19 metre or 15 megacycle band.

LISTENERS who buy the new sets this season fitted with short-wave tuning ranges can scarcely fail to become short-wave minded, and the author sets out to try to acquaint them with what may be expected from the new tuning bands.

Here in the afternoons three of the Berlin transmitters, DJL on 19.85 metres, 15.11 megacycles, DJB on 19.74 metres, 15.20 megacycles, and DJL on 19.63 metres, 15.28 megacycles, may often be heard working simultaneously, using directional or beam aerials on various parts of Eastern Asia.

It is interesting to note that these are therefore strictly not "broadcast" transmissions and the signal heard in this country is due to wasted energy, thrown upwards at high angles by the reflector at the back of the beam aerials; curiously enough this wasted energy is only really well heard at distances of about 500 miles behind the reflector, and is more or less inaudible elsewhere!

There are three American stations working in this band, W2XAD, W8XK and W2XE, of which W2XAD on 19.56 metres, 15.33 megacycles, is the best heard. In September the best time for tuning in to America on this band is from noon until midnight, practically the same as for the 17-metre band, with peak reception between 9 and 11 p.m. B.S.T.

The U.S. transmitter W2XAD normally functions as a broadcast station, that is, it radiates energy equally in all directions; at times, however, it uses a beam aerial directional on Europe, when it is received exceptionally well, often having "entertainment value" equal to that of the local B.B.C. transmitter, i.e., the signal is strong enough to over-ride the noise, and does not show marked fading.

The next mark on the scale indicates the 25-metre or 12-megacycle band, and here the best heard station is Rome on 25.4 metres, 11.81 megacycles, which can be received very strongly every day from noon or earlier to late evening.

Several other "locals" are heard well, too, in this band, for example, Berlin DJD and DJO and Paris TPA3 and TPA4. The two French stations practically mark the bottom and top of the band respectively, the former being in use during the afternoon and evening and the latter late at night; they are occasionally very strongly received. For distant reception this band may be regarded as the evening band, and after sunset fair signals may be obtained from the Americans W1XAL and W8XK, Boston and Pittsburgh.

W1XAL works on 25.45 metres, 11.79 megacycles, W8XK on 25.27 metres, 11.87 megacycles, and W2XE on 25.36 metres, 11.83 megacycles.

Scope for the Enthusiast

The next turn of the tuning dial takes one to the 31-metre or 9-megacycle band, the night band for distant stations, but producing extremely loud signals from the local European stations such as Jelöy, LKJ1 on 31.48 metres, 9.53 megacycles and Berlin DJA and DJN on 31.36 and 31.4 metres, 9.56 and 9.54 megacycles respectively.

The band also contains the three Australian stations VK2ME on 31.28 metres, 9.59 megacycles, VK3LR on 31.3 metres, 9.58 megacycles, and VK3ME on 31.5 metres, 9.51 megacycles, of which the former is quite well heard at times, but only works on Sundays; during August

All-wave Listening

By "ETHACOMBER"

the best time to tune for VK2ME would be from 5.30 to 7.30 p.m., and during September one hour earlier than this.

The best results from VK3LR are to be obtained in the early morning before breakfast, and VK3ME, the most difficult of this group to receive, works from Mondays to Saturdays between 10 a.m. and 1 p.m., but is very rarely picked up in this country.

Several N. and S. American stations also work in this band, the best known of which is W2XAF on 31.48 metres, 9.53 megacycles, the sister station to W2XAD.

W2XAF is normally only weakly audible in this country at the present time, since most of its transmissions are made on an aerial directional to S. America, but at times an alternative aerial is used when excellent signals of good programme value may be picked up. During September, W2XAF will be best received, if working, from 9 p.m. onwards, and this listening period will also give the best results for other western transmitters in this band, namely W3XAU, of the Columbia System, relay of WCAU, and WIXK, Boston; this latter and the two Schenectady stations W2XAD and W2XAF relay the programme of the National Broadcasting Company.

"Five Hours Back"

It should be noted that W2XAF and LKJI both use the same frequency and for this reason only very poor reception of W2XAF can be expected when LKJI is working during the summer months; during the winter months LKJI often fades out with nightfall before W2XAF commences operations—it being remembered that nightfall in the U.S.A. is five hours later than here.

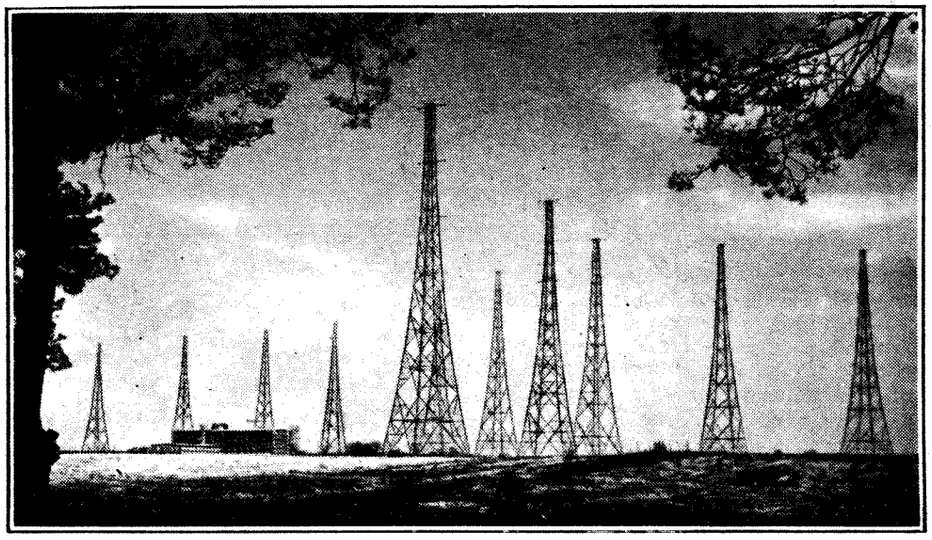
The last marking on the scale indicates the position of the 49-metre or 6-megacycle band, in which there is theoretically room for 16 stations spaced by 10 Kc/s, which is the normal short-wave spacing, and is 1 kilocycle greater than that allotted to stations in the medium and long wave bands.

Actually in or near to this band some 50 or 60 stations are working but fortunately not all at the same time.

The easiest received stations in this band, all of which possess good entertainment value on all but the most atmospherically disturbed nights, are the Vatican HVJ on 50.26 metres, 5.97 megacycles (actually just outside the band), Moscow RNE on 50.0 metres, 6.0 megacycles (note 6 x 50=300), Berlin DJC on 49.83 metres, 6.02 megacycles, Skamlebäk OXY on 49.5 metres, 6.06 megacycles, Vienna OER2 on 49.4 metres, 6.04 megacycles and Belgrade on 49.18 metres, 6.10 megacycles.

A fairly good performer in this band in the early evenings is VQ7LO Nairobi on 49.31 metres, 6.08 megacycles, which may be picked up just between Vienna and Belgrade (announced as Radio Beograd—Vienna is, of course, called Radio Wien).

Late at night this band will be found to be packed full of Central and South American stations and may be called the short-wave enthusiast's paradise. Here hours can be spent chasing and identifying elusive transmitters.



A HIVE OF RADIO ACTIVITY. A short distance outside Berlin in the districts of Konigswusterhausen and Zeesen is to be found a forest of masts carrying the aerials of broadcast and commercial stations whose transmissions will be found on the normal wavelengths covered by an all-wave receiver. Our photo shows one corner of the Zeesen group.

The Vatican transmitter HVJ also works in the 19-metre or 15-megacycle band, actually on 19.84 metres, 15.12 megacycles, where it may be strongly received at 4.30 p.m. most afternoons; on 50.26 metres or 5.97 megacycles it may be heard at either 11 a.m. on Sundays or at 8 p.m. on weekdays.

It will have been noted that a not too rosy picture has been painted of reception of the more distant stations, but the prospective short-wave listener should not be downhearted, for reception of some of the most elusive stations often proves to be quite easy on certain nights—and some of the lowest powered stations occasionally give excellent loud-speaker reception.

Future Improvements

One can take heart, too, from the fact that improvements on short-wave transmitting technique are continually being made, and many of the American stations are contemplating the use of beam aerials and higher powers to ensure future good reception in this country, notwithstanding that it is already excellent on many occasions.

Not all the short-wave stations now operating work within the five bands mentioned above, a notable exception being EAQ Madrid on 30.4 metres, 9.86 megacycles, but these bands do afford excellent landmarks in the formerly wide-open but now thickly populated spaces of the short-waves.

In searching for weak or distant stations it is a good plan first to locate the appropriate or nearest band, and then to find a strong station whose frequency or wavelength is adjacent to that of the desired station; for example: as shown earlier, VQ7LO Nairobi is located between Vienna and Belgrade, both of which are normally strong signals, and LRU Buenos Aires on 19.62 metres, 15.20 megacycles is next door to Berlin DJQ.

A final remark with regard to frequencies—which may be given in either megacycles or kilocycles (strictly megacycles or kilocycles per second)—a megacycle equals a thousand kilocycles so that to convert kilocycles to megacycles you have only to change the comma between the 3rd and 4th figures to a decimal point, and you have the answer in megacycles—viz., 11,750 Kc/s=11.75 Mc/s; megacycles are generally favoured for dial marking purposes because 11 takes up much less room than 11,000, obviously.

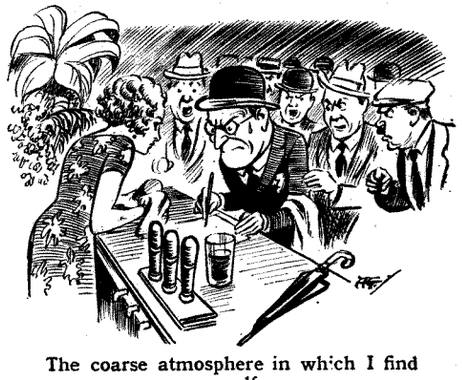
Summing up, therefore, on the short-waves one can tune in to Europe all day, to Australia and the Antipodes for a period around sunrise and sunset, to Africa, afternoon and early evening, to the Americas during the afternoon, evening and night—the late evening being the most favourable time.

The Far East may be tuned in at various times, Tokio generally between 8 and 9 p.m. on JVM 27.93 metres, 10.74 megacycles and Bandoeng, Java on either PMA 15.51 metres, 19.34 megacycles during daylight or on PMN on 29.41 metres, 10.2 megacycles after midnight.

FREE GRID at OLYMPIA

Some Startling Facts Revealed

I SUPPOSE that a good many of you will read these lines in more or less the self-same place as I am writing them, namely, at one of the numerous bars which infest Olympia. I must frankly confess that I am not at all happy in having to write these notes amid the coarse atmosphere in which I find myself, more especially when I remember that they will be read by many of my lady readers, but unfortunately I have no option in the matter. There has been much talk in the newspapers of late concerning the marvellous new improvements at Olympia, including vestibules, bath rooms and such-like evidences of the luxury which ruined



The coarse atmosphere in which I find myself.

ancient Rome, but as for the necessities of life, such as a writing room, there is absolutely nothing, not even a tape machine whereby we can learn of the up-and-down movements of our investments at York.

A Base and Baseless Rumour

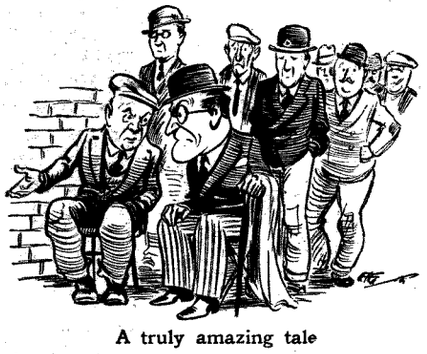
These improvements and renovations which are being so feverishly carried out are, in my opinion, long overdue, although even the baser side of my nature cannot credit the rumours that it is all due to a frantic effort to stem the great hegira to a new Exhibition Hall which is rising Phœnix-like from the ashes of the old pre-war "Shakespeare's England," a few hundred yards away. Such rumours can only spring from the mind of a person who has long since lost all sense of decency, and it ill behoves you or I to sully our minds by contact with such baseness.

However, it was not of improvements at Olympia about which I wished to speak to you, but of the deplorable and scandalous state of affairs existing in the wireless industry to which this year's Exhibition has been the means of fully opening my eyes. As you may remember, the wireless exhibition has invariably been such an astounding success from the set-selling point of view that stand-holders have sold out the complete output of their factories for months ahead during the first hour or so of the Exhibition being opened, and long before it is closed they have literally booked orders for years ahead.

It is not surprising, therefore, that the exhibition organisers have become almost frantic in their efforts to allow the factories to catch up with orders, by diverting the minds of the public from buying wireless sets, and it is for this reason that they have had to introduce strong counter-attractions in the shape of variety theatres, displays of feminine legs, coconut shies and all the fun of the fair, the actual wireless exhibits being relegated to a place of secondary importance.

In spite of all this, however, it has had comparatively little effect, and firms are still losing ground in their desperate efforts to stem the ever-rising tide of orders. As most of you know, in past years many other plans have been tried to keep the public from buying wireless sets, such as the deliberate introduction of technical faults into receivers so that they had to be returned to their makers. Notwithstanding these efforts at discouragement the public are still as keen as ever on wireless, and so the problem has yet to be solved.

You may wonder why it is that I feel so exceptionally strongly upon this matter, and I will therefore tell you. For several years past I have been unable to buy a new set simply because I have not been physically strong enough to force my way through the crowd which is always surging round the door at the hour of opening. The result has been that, by the time I have got to the Exhibition Hall, the year's output of the various exhibitors' factories has long since been snapped up. This year I resolved to make a great effort, however, and, taking a tip from theatrical



A truly amazing tale

first-nighters, I arrived at the main entrance armed with a camp stool on the evening preceding the opening day in a determined effort to be at the head of the queue.

To my dismay, I found when I arrived, that a large number of people were already in position, and I was compelled to take my place a good way down the line. As the night wore on I could not help noticing that in comparison with myself, the various members of the queue, all of whom were men, were dressed in singularly shabby style, most of them in fact having their knees and elbows out, and I fell to wondering how it was that these unfortunate people could possibly afford to pay for admittance to the exhibition, let alone buy a set.

A Sobstuff Story

Eventually my curiosity got the better of me and I entered into conversation with my immediate neighbour, who unfolded to me a truly amazing tale. He was, I discovered, a very well known wireless engineer of almost international repute who had once been the chief designer for a very important firm of set makers. It appears from what he told me that it was the very prosperity of the wireless manufacturing industry which had brought him to this pass. Owing to the enormous sales at last year's wireless exhibition the whole factory output of the firm with which he was associated had been sold for no less than seven years ahead, with the natural result, of course, that the firm had no further use for a designer, since anything new which he produced could not be put into production for at least this number of years.

My newly found friend was by no means the only member of his profession in this terrible predicament, however, for he explained to me that he believed that, with the exception of myself, the entire queue was made up of his fellow designers from other firms. Upon looking a little more closely I found that this was indeed the case, for through the hardened layer of grime on their faces I recognised several well-known engineers of my acquaintance who had been cast off by the heartless manufacturers who had formerly employed them. As for the reason why they were all there, I found that this was a psychological one very closely allied to the well-known Call of the East. As you may know people who have lived out East are unable to resist its mysterious glamour.

I find that I have left myself no space to tell you of the exhibits at the Show, but perhaps this is just as well, for I have not seen them myself yet as I made it my first duty on entering Olympia to go at once to the bar in order to record these preliminary impressions for you. I am feeling a little better now and in a more fit condition to try to find my way out of this jungle of sideshows to the real exhibits.

B.B.C.'s Power Policy

ALTERNATIVE METHODS OF INCREASING RANGE

By ALAN HUNTER

TO the incipient alarmist the repeated raising of transmitting power among European stations seems to provide unequivocal proof of impending chaos. Every time a low-power station is replaced by a modern high-power plant it is assumed by some observers that reception conditions will be a little worse generally.

Yet the history of broadcasting shows that power, as such, is not the determining factor in reception; the wavelength used by the station and the level of noise at the receiving end are two factors that may, either singly or together, counteract or even nullify a power increase.

One recent example proves this point. When Midland Regional was raised in power its wavelength was lowered; the result is that in the south what used to be a good signal is now very poor indeed. True, the aerial at Droitwich, where the new Midland Regional is situated, was directed to give a polar diagram most favourable to the north-east; but this is, if anything, just another example of how power can be misleading if considered alone.

Many of Europe's obsolescent transmitters are being replaced during the coming months. The opportunity is being taken to increase the power of some stations to a spectacular degree; little 1-kW stations will blossom forth as 60 or 100 kW.

Europe's Race for Power

According to Mr. Arthur Burrows, the Secretary-General of the International Broadcasting Union, about 200 new transmitters are either under construction or projected; of these, 36 are due to open this year, three with 150 kW, one with 120 kW, and three with 100 kW.

It would be easy to cite this information as further evidence of a race for power. And yet, when the Lucerne Plan is examined for a moment, it becomes clear that European broadcasters are merely taking advantage of the power agreement contained therein.

Above 1,000 metres a maximum of 150 kW is allowed; between 545 and 272.7 metres, 100 kW; between 272.7 and 240 metres, 60 kW; and between 240 and 200 metres, 30 kW.

The several notable exceptions to this agreement, such as Budapest, Prague No. 1, Paris PTT, Marseilles PTT, Toulouse PTT and Leipzig, are explained away by the fact that these transmitters were either in action or in course of construction when the Plan was formulated.

So, at least, I am given to understand by Sir Noel Ashbridge, the B.B.C.'s Controller of Engineering. I went to ask him how the B.B.C. proposed to shape its power policy in the light of European developments. He replied thus: "In deciding on the transmitting power of our new stations we consider the existing regulations or any possible modifications of those regulations."

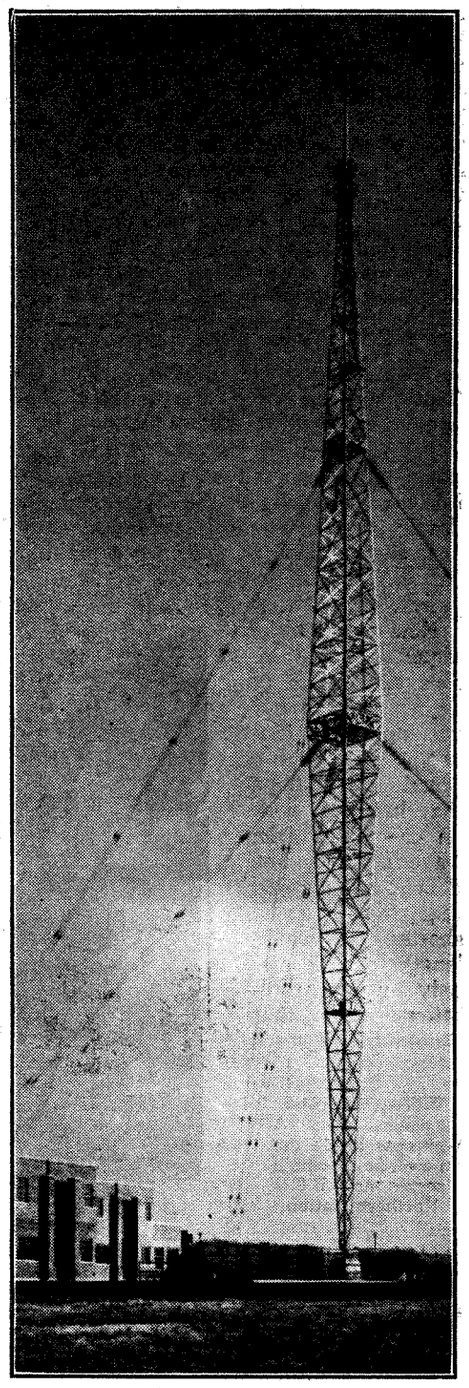
He certainly does not take an alarmist view of developments abroad. Nor, emphatically, does he intend to embark on a race for power—no matter how flagrantly other countries may depart from the Lucerne Plan's stipulations.

The B.B.C.'s Proposals

The B.B.C. has always adopted the view that there is an economic maximum power for a given wavelength, beyond which it is a waste to go. The aim with B.B.C. transmitters is to provide a reasonably high field strength within the effective non-fading service area. If, at the limits of the reliable service radius, the field strength rises well above noise level, no particular point is gained by increasing the power.

There is, too, a real disadvantage in doing so if distant listeners are taken into account. For with power raised above the economic maximum the down-coming sky waves cause strong interference in other countries.

I asked Sir Noel Ashbridge whether, in his view, the development of the anti-near-fading type of aerial, as used at the Northern Ireland Regional station, materially altered the attitude towards the economic limit.



The success of the Lisnagarvy anti-fading aerial has been so marked that it is being adopted for other new transmitters.

"Most decidedly," he replied. "The effect of this type of aerial is to extend the non-fading service area. An increase in transmitting power may, therefore, be justified in order to give listeners at the fringe of this extended service area a reasonably high field strength."

From what the Controller said, I gather that the 100 kW power now being used by Lisnagarvy may not necessarily be the maximum economic power. When the Lucerne figures were agreed to over two and a half years ago very little was known of the anti-fading aerial's advantages. When the Plan is revised, therefore, it is more than possible that the limit for 545 to 272.7 metre stations may be raised at least to 120 kW.

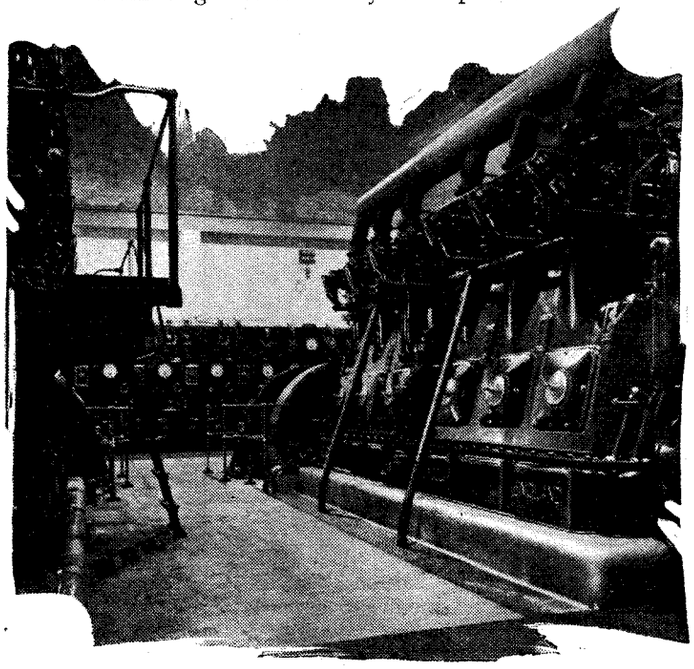
B.B.C.'s Power Policy—

Meanwhile, the B.B.C. has decided to raise the power of its existing stations to the maximum they are designed for. London, North and West Regionals, hitherto restricted to 50 kW, have gone up to 70 kW. They are now fully extended, says Sir Noel Ashbridge, and cannot be further raised without considerable modification.

The new stations at Burghead and Stagshaw will be rated at 100 kW and will be fitted with anti-near-fading aerials. Whether these Regionals will be able to use the full power depends, says the Controller, on what wavelengths they work on.

It appears, then, that the B.B.C. engineers are determined not to be stampeded into a power race; on the other hand, the development of the anti-near-fading aerial has allowed them to envisage a substantial increase in worth-while transmitting power.

New aerial technique opens up possibilities of higher power; but an opposite tendency may be noted for stations that have to work on a common wavelength. The B.B.C. has decided that the acute shortage of wavelengths can be met only by synchronisation; when that is done the power is lowered, not raised. We have the example of London, North and West Nationals, dropping from 50 to 20 kW.



Where the power comes from. A glimpse inside the power house which serves the B.B.C.'s Northern station.

Here, again, the B.B.C.'s attitude is perfectly logical. With stations on the same wavelength the most important factor in fixing the power is the incidence of the "mush" area. High power, by increasing the power of the downcoming rays at night, would actually decrease the service areas of the stations tied together to a common frequency.

While I was discussing the question of power with Sir Noel Ashbridge I asked him whether he could give me any indication as to the rating of the new Empire short-wave transmitters being installed at Daventry.

He could not, apparently. A figure of 40 kW has been widely quoted for the new Empire stations, I know. But I could gain neither a denial nor a confirmation of this belief. The secrecy is due, I think, to international rivalry. I gained the impression that we shall maintain parity of power with all comers. The inference is obvious.

Distant Reception Notes

SOME NEW STATIONS

NO one who has followed the history of broadcasting in France in recent years can fail to appreciate the splendid work done by M. Mandel, who was Minister of Posts and Telegraphs in many successive Governments. The development of the Ferrié Scheme is due largely to his energy, and it was he who successfully steered through the Chamber of Deputies the anti-interference bill, despite stern opposition from many quarters. Though he is no longer Minister, you will be glad to know that he is Chairman of the Committee which looks after French broadcasting, and he had no doubt a good deal to do with the new broadcasting bill which is at present being considered by the Deputies.

The interference from spark signals at the upper end of the medium waveband, which I mentioned some weeks ago, shows few signs of improvement. Though I am nearly as far from any coast as it is possible to be in this country, I find that it often extends from the top of the band down to about 450 metres. One powerful and very broadly tuned station which I have not so far identified is sometimes to be heard from the highest tuning point of the medium-wave scale down to a little above 420 metres. I shall be glad to know if any reader has identified this station—I can never catch it when it is giving its call-sign.

More Power for Poland

Lwow, before the coming of the present Lucerne Plan, was one of the most strongly heard of Continental stations. Evening after evening one could tune it in with complete certainty. Since then it has been sandwiched in between Leipzig and West Regional, besides sharing a wavelength with Barcelona EAJI. It isn't, therefore, a station of which one hears very much now. However, something like a rebuilding has been in progress for some months, and very soon now Lwow will be working with 50 kilowatts instead of the present 16. Another Polish station, Wilno, may be just above the tuning range of some receivers, for its wavelength is 559.7 metres, which it shares with Bolzano. Wilno is also going up to 50 kilowatts, and if your set will tune to a little above Budapest's wavelength good reception should be obtainable at times when Bolzano is quiet. When the new stations are in action, Poland should have a pretty good broadcasting team with two transmitters at Warsaw and others at Wilno, Katowice, Lwow, Poznan, Cracow, Torun, and Lodz. Only three of these—Lodz, Cracow, and Warsaw No. 2—are small stations rated at 2 kilowatts apiece. All of the others have power outputs between 12 and 150 kilowatts.

For Real DXers

Those dyed-in-the-wool DX-men who think no station worth receiving unless its power is minute may care to know that Salonika is again working on 235.5 metres after a two years' silence. This is a private station, and it appears to be carrying on until the Greek Government's regional scheme comes into being.

The Indian regional scheme has now received Government approval, and it will take shape on lines slightly different from those recommended by the Commission which recently enquired into the matter. There will be a central station at New Delhi relaying the Daventry Empire programmes and sending out programmes of its own. This, however, may be not a long-wave station as originally recommended, but a high-powered short-waver. The reason is probably that most of the bigger sets in use in the country have a short-wave range, though comparatively few take in the long waves.

In addition to the central station which will always send out programmes in English, there will be a 20-kilowatt station in each province as well as a whole series of small stations which will transmit in the almost innumerable local dialects.

—D. EXER.

An Institute of Public Address

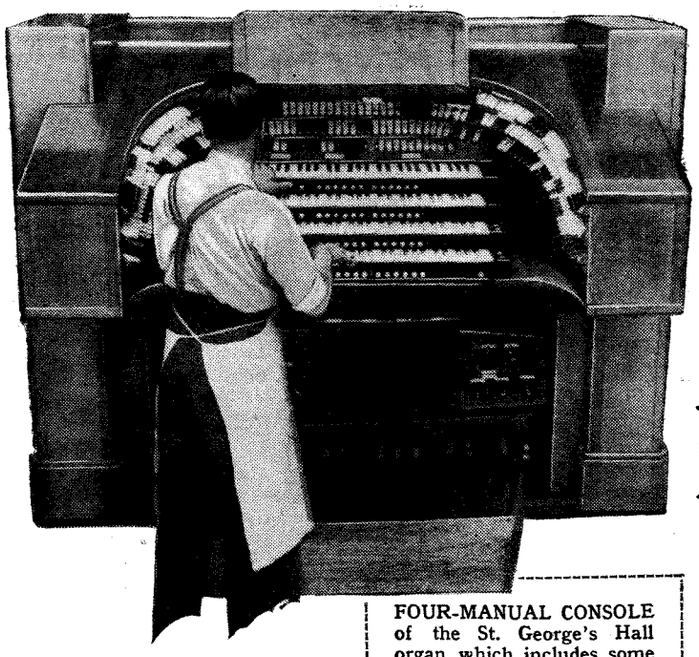
IN view of the widespread use of public address equipment to-day, a suggestion has been made that a central body be formed to exercise a measure of control over its proper use and also to look after the interests of those engaged in this business. This has met with such support throughout the country that arrangements are now well advanced towards the formation of the Public Address Institute.

Among its objects is to confer on members a status equivalent to that obtaining in other callings having the advantage of a professional association.

PA engineers and contractors interested in the scheme can obtain full details from the acting secretary, Mr. L. B. Candfield (Ross & Robinson, Ltd.), 8, Western Circus, London, W.3.

Broadcast Brevities

NEWS FROM PORTLAND PLACE



FOUR-MANUAL CONSOLE of the St. George's Hall organ, which includes some 250 stop key tabs for the control of a full range of effects from the warbling of a bird to a grand crash. Where is the super organist for this Gargantuan instrument?

St. George's Hall Organ

DURING the first two weeks of October, St. George's Hall will resound with the preliminary strains of the new theatre-cinema-concert organ (how else can one describe such a Gargantuan and versatile instrument?); but listeners will probably hear it for the first time during the middle week of that month.

According to present plans, the organ may be heard at least twice a week thereafter in solo programmes; also, of course, it will be used in variety and other broadcasts.

Finding the Time

When the Maida Vale organ is completed, the B.B.C. will possess three of the finest instruments in the country, and the problem will then be to give all of them a fair showing each week.

Conditions have changed since 1922, when the only "organ" music in the British programmes was produced by a glorified harmonium in an upper room at Savoy Hill.

Praise and Blame

IN charitable moments the listening public is apt to sympathise with the poor old B.B.C. because of the widespread notion that it always receives more kicks than ha'pence. Undoubtedly the Corporation is an "Aunt Sally" of sorts, and probably always will be, but this idea that it deserves a martyr's crown is all wrong.

Analysis of listeners' letters received at Broadcasting House reveals that the percentage of grumbles is surprisingly low.

In some weeks, praise and gratitude are the theme of eighty per cent. of the letters received. Many of the remainder may be of a non-committal nature, leaving a comparative few containing censure. The last range from gentle reproofs (usually constructive) to virulent outbursts (usually destructive).

The bulk of recent complaints have been with regard to the curtailment of Promenade Concert broadcasts.

One Better than Radiolympia

THE popularity of the Children's Hour broadcasts from Radiolympia proves that the public loves to sense the atmosphere of the broadcast studio. American broadcasters have realised this from quite early days and few radio shows are held in which visitors cannot see microphone favourites "doing their stuff" in the flesh.

The N.B.C. recently elaborated the idea by introducing a revolving broadcast stage at the Great Lakes Exposition at Cleveland. Two studios, built back to back, were erected on a 44ft. diameter wooden disc which could be revolved through 180° in forty seconds, revealing a complete change of scene and a fresh group of artists.

Of course forty seconds constitutes a long interval in American broadcasting, but no doubt the announcer provided a vivid commentary during the revolutions.

Talent Hunting

MR. FRANCIS BOLTON, the "Talent Spotter" on the staff of the B.B.C. Variety Department at London headquarters, is in the provinces again looking for new material, in spite of the disappointing results of his last tour.

An elaborate series of auditions have been planned by the North Regional authorities for Mr. Bolton to attend. Normally auditions are held in the North at the Manchester, Leeds or Newcastle studios, but in September and October special auditions will be held in the following Northern towns: Carlisle (Sept. 7th), Barrow-in-Furness (8th), Blackburn (9th, 10th, and 11th), Blackpool (14th and 15th), Liverpool (16th, 17th, 18th and 19th), Chester (21st), Sheffield (22nd, 23rd, 24th and 25th), Lincoln (26th), Hull (28th, 29th and 30th), Darlington (Oct. 1st and 2nd).

Premises are being rented in these towns for the auditions, and music shops seem to be a favourite choice.

It is expected that about 1,500 applicants will be heard by Mr. Bolton. The tests will not be by microphone, but candidates who are passed by Mr. Bolton will be offered further studio auditions.

Mr. Bolton is also to visit the West Regions.

Welsh Programmes from England

WELSH listeners are still obsessed by the depressing thought that Welsh Regional is on English soil. No amount of self-deception can, of course, place Watchet on the other side of the Bristol Channel, but the advice which the B.B.C. has handed out to Welshmen for the last six months is that they should try to remember the technical advantages of the Somerset site.

Put the transmitter in Wales and its service area would be patchy at the best and probably considerably restricted in scope. Possibly some Welshmen would prefer poor signals from Welsh soil to good ones from England, but this seems difficult to believe.

First Jobs at the Palace

ONE of the first tasks of the B.B.C. Television staff when they took possession of their offices at Alexandra Palace was fire drill. As the white-smocked figures assembled in the corridors they were given instructions as to immediate procedure when the fire whistles blew.

Actually, the risk of fire damage in the B.B.C. wing of the Palace is not great, for, as at Broadcasting House, the most elaborate precautions have been taken. Hydrants and fire extinguishers have been placed at every strategic point; moreover, the work is not of a combustible nature, except in the case of the film projection room, and this is fully fire-proofed in the approved cinema style.

No building, however, is quite exempt from the threat of fire, but it would be a cruel irony of fate if a conflagration occurred during the first days of the long-awaited television transmissions.

Actually, such an event would have a precedent, for the original Alexandra Palace was burnt to ashes within a month of the official opening in May, 1873. Nothing daunted, the owners built a new palace within two years.

How Should He Know?

A LOVELY "wireless" story —and a true one withal— is being told by Felix Felton, the B.B.C. producer, who has just returned from a Mediterranean cruise.

Near Gibraltar a woman passenger asked him what horse had won the first race at Goodwood. "How should I know?" said Felton. "The race is probably being run at this moment." The lady was not satisfied. "Surely you can tell me," she persisted. "I just *can't* tell you," pleaded Felton, "but probably the result will come through on the wireless." "Oh, no, it won't," said the fair one. "It's far too foggy to-day."

Not Television

LYNX-EYED observers proceeding up Regent Street have noticed a rearrangement of the ultra-short aerial on the roof of Broadcasting House, and the general conclusion has been that the change must be connected with television developments. It is understood, however, that this is not the case; the aerial modifications are concerned purely with experimental work with the 7-metre transmitter.

Exhibitors at Olympia

ALPHABETICAL LIST WITH STAND NUMBERS AND REFERENCES TO THE PLAN OPPOSITE

Name.	Stand.		
AERIALITE, Ltd.	9	D	3
Aerodyne Radio, Ltd. ..	74	A	3
Aeronautical & General Instruments, Ltd. ..	30	D	4
All Power Transformers, Ltd.	206	H	4
"Ardente" Acoustic Laboratories	3	D	4
Armstrong Manufacturing Co., Ltd.	224	E	4
Automatic Coil Winder & Electrical Equipment Co. Ltd.	31	D	4
BALCOMBE, A. J., Ltd. ..	41	C	2
Barratt & Robinson, Ltd. ..	226	G	1
Beethoven Radio, Ltd. ..	34	D	3
Belling & Lee, Ltd.	98	A	1
Benjamin Electric, Ltd. ..	91	C	1
Bridger, R. O., & Co., Ltd. ..	211	G	4
Britannia Batteries, Ltd. ..	71	A	2
British Broadcasting Corporation	38	C	1
British G.W.Z. Battery Co., Ltd.	67	B	1
British N.S.F. Co., Ltd. ..	69	A	2
British Pix Co., Ltd. ..	96	B	1
British Rola Co., Ltd. ..	209	G	4
British Tungsram Radio Works, Ltd.	93	C	1
British Wireless for the Blind Fund	33	B	3
"Broadcaster, The" ..	90	C	1
Brown Brothers, Ltd. ..	T25	E	3
Bulgin, A. F., & Co., Ltd. ..	T8	H	2
Burgoyne Wireless, Ltd. ..	1	C	4
Burndept, Ltd.	75	A	4
Bush Radio, Ltd.	65	B	2
CADISCH, R., & Sons ..	50	C	2
Celestion, Ltd.	T10	H	2
Chloride Electrical Storage Co., Ltd.	24	D	2
City Accumulator Co., Ltd. ..	32	D	4
Cole, E. K., Ltd.	18	D	1
Collaro, Ltd.	53	B	1
Cosmocord, Ltd.	70	A	2
Cossor, A. C., Ltd.	78	A	2
Crypton Equipment, Ltd. ..	55	B	2
DALLAS, John E., & Sons, Ltd.	202	H	4
Davies, D. M., Woodwork ..	T23	E	3
Davis & Timmins, Ltd. ..	17	D	1
Decca Gramophone Co., Ltd.	210	G	4
De La Rue, Thos., & Co., Ltd.	44	C	4
Department of Overseas Trade	6	D	4
Dew, A. J., & Co., Ltd. ..	85	B	1
Dibben, Horace, Ltd. ..	T6	H	3
Diggle, Alfred, & Co., Ltd. ..	T15	E	1
Dubilier Condenser Co. (1925), Ltd.	15	D	1
Dulcetto Polyphon, Ltd. ..	39	C	1
Dyson, J., & Co., Ltd. ..	T19	E	2
EASTICK, J. J., & Sons ..	T2	H	3
East London Rubber Co., Ltd.	T24	E	3
Eavestaff & Sons, Ltd. ..	T9	H	2
Edison Swan Electric Co., Ltd.	225	F	1
Ensign, Ltd.	42	C	3
Epoch Reproducers, Ltd. ..	T22	E	2
Ever Ready Co. (G.B.), Ltd.	94	B	1
Everett, Edgcumbe & Co., Ltd.	58	B	4
FARREX Radio	213	C	4
Ferranti, Ltd.	218	E	4
" "	8	D	3
" "	63	B	3
Film Industries, Ltd. ..	216	F	4
Flinders (Wholesale), Ltd. ..	4	D	4
Fuller Accumulator Co., Ltd.	T16	E	1
GARRARD Engineering & Manufacturing Co., Ltd.	101	A	2
General Electric Co., Ltd. ..	37	D	1
Gilbert, C., & Co., Ltd. ..	40, 51,	C	2
Goodmans Industries, Ltd. ..	T14	H	1
Gorst Electrical Co., Ltd. ..	87	B	1
Gramophone Co., Ltd., The	46	C	4
Grampian Reproducers, Ltd.	54	B	2
H.M.V. (See The Gramophone Co., Ltd.)	21	D	1
Hacker, H., & Sons ..	29	D	3
Harmer & Simmons, Ltd. ..	217	E	4
Harries Thermionics ..	2	D	4
Haynes Radio	13	D	2
Heayberd, F. C., & Co. ..	25	D	2
Hendersons Wholesale Electrical & Radio, Ltd. ..	T17	E	1
Henley's, W. T., Telegraph Works Co., Ltd. ..	28	D	3
High Vacuum Valve Co., Ltd.	26	D	3
Hillman Brothers, Ltd. ..	T3	H	3
Hobday Brothers, Ltd. ..	T20	E	2
ILIFFE & Sons, Ltd. ..	7	D	4
Invicta Radio, Ltd.	35	D	2
Ismay Distributors	73	A	3
JACKSON Brothers, Ltd. ..	81	A	1
KINGSWAY Electricals, Ltd.	88	C	1
Kolster-Brandes, Ltd. ..	57	B	3
LECTRO Linx, Ltd.	82	A	1
L.E.S. Distributors, Ltd. ..	T21	E	2
Linguaphone, Ltd.	106	B	4
Lissen, Ltd.	64	B	2
London Electric Appliances, Ltd.	212	G	4
Lugton & Co., Ltd.	T5	H	3
MANUFACTURERS Accessories Co. (1925), Ltd. ..	T7	H	3
Marconiphone Co., Ltd. ..	49	C	3
McMichael Radio, Ltd. ..	47	C	4
Milnes Radio Co., Ltd.	205	H	4
Mullard Wireless Service Co., Ltd.	62	B	3
Multitone Electric, Ltd. ..	86	B	1
NEW London Electron Works	22	D	2
PARTRIDGE Wilson & Co., Ltd.	107	B	4
Philips Lamps, Ltd. ..	43	C	3
Plessey Co., Ltd.	27	D	3
Prism Manufacturing Co. ..	80	A	2
Primographic Co., Ltd. ..	223	E	4
Primus Manufacturing Co. ..	1A	C	4
Pye Radio, Ltd.	48	C	3
RADIO Gramophone Development Co., Ltd.	56	B	3
Radiometers, Ltd.	203	H	4
Radio Resistor Co., Ltd. ..	16	D	1
Radio Society of Great Britain	214	F	4
Radio Wholesalers Federation	T1	H	4
Rawlplug Co., Ltd.	79	A	2
Reproducers & Amplifiers, Ltd.	92	C	1
Rists Wires & Cables, Ltd. ..	208	G	4
Rothermel, R. A., Ltd. ..	89	C	1
SELECTA Gramophones, Ltd.	T11	H	2
Self Changing Gramophones, Ltd.	59	B	4
Shaftesbury Microphones, Ltd.	99	A	1
Siemens Electric Lamps & Supplies, Ltd.	60	B	4
Sound Sales, Ltd.	76	A	3
Stratton & Co., Ltd.	23	D	2
TANNOY Products	45	C	4
Telegraph Condenser Co., Ltd.	68	A	1
Thompson Diamond & Butcher	T4	H	3
Tucker Eyelet Co., Ltd. ..	105	A	3
362 Radio Valve Co., Ltd. ..	207	H	4
ULTRA Electric, Ltd. ..	52	C	1
Union Radio Co.	20	D	1
VARLEY (Oliver Pell Control Ltd.)	77	A	2
Vidor, Ltd.	61	B	4
WATERHOUSE, Frederick, Ltd.	201	H	4
Webber, J. M., & Co., Ltd. ..	T13	H	1
Westinghouse Brake & Signal Co., Ltd.	36	D	2
Weston Electrical Instrument Co., Ltd.	215	F	4
Wharfedale Wireless Works .	204	H	4
Whiteley Electrical Radio Co., Ltd.	66	B	1
Wingrove & Rogers, Ltd. ..	97	B	1
"Wireless Trader, The" ..	T26	E	4
"Wireless World, The" ..	7	D	4
Wright & Weaire, Ltd. ..	95	B	1

"THE WIRELESS WORLD" STAND NO. 7

The

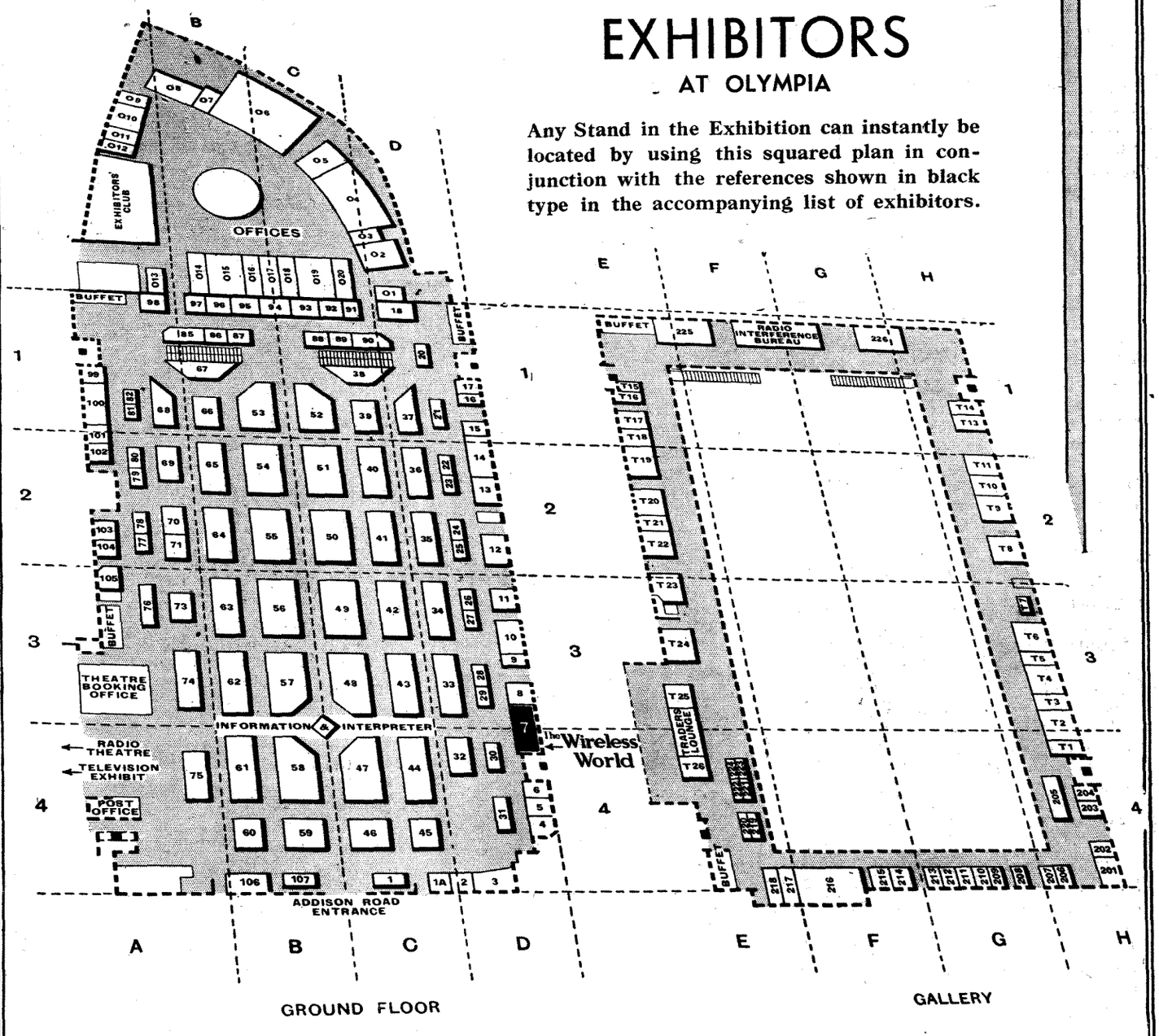
Wireless World

STAND FINDER

GUIDE TO EXHIBITORS

AT OLYMPIA

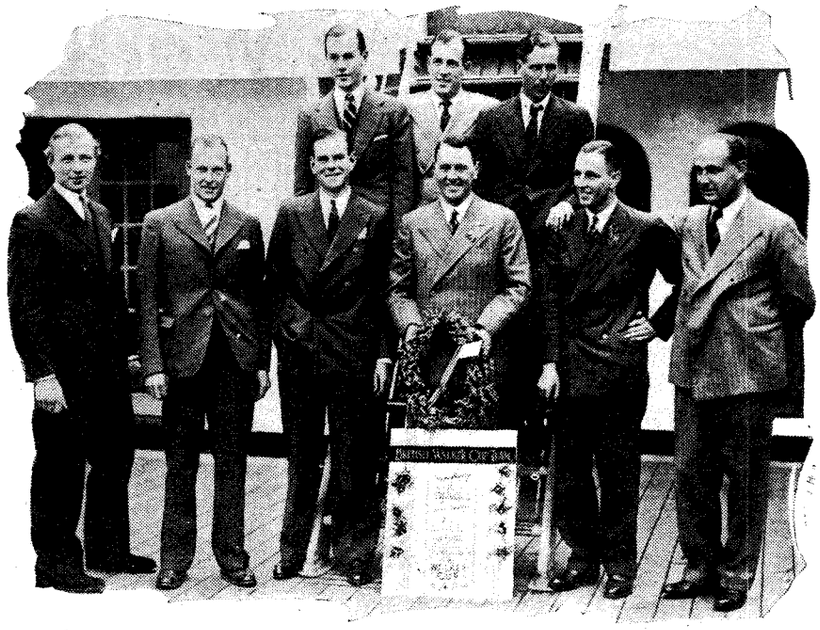
Any Stand in the Exhibition can instantly be located by using this squared plan in conjunction with the references shown in black type in the accompanying list of exhibitors.



A selection of Constructional Receivers recently described in the pages of this journal will be on view at "The Wireless World" Stand (No. 7).

Listeners' Guide for

RELAYS from abroad are becoming regular features of the programmes. This week is included three from America. On Tuesday at 7.30 listeners will hear for half an hour Paul Whiteman and his band relayed from Fort Worth, Texas. The other two relays are to be eye-witness accounts of the golf competition between Great Britain and the United States for the Walker Cup on Wednesday and Thursday at 11.5 (Nat.). The teams are to play over the Pine Valley Course, New Jersey. The Walker Cup has never left America since it was presented to the United States Golf Association as a Challenge Trophy by Mr. George H. Walker in 1922.



THE BRITISH WALKER CUP TEAM on board the "Transylvania" en route for America. From the Pine Valley Golf Course commentators with short wave transmitters strapped to their backs will give descriptive broadcasts of the play twice this week.

FROM THE PROMS.

EACH evening this week brings a relay from the Queen's Hall. Solomon will play Beethoven's "Emperor" Concerto in to-night's Prom. at 8 (Nat.). Lamond was to have played this, but is prevented from doing so owing to illness. Saturday's concert provides two broadcasts, at 8 (Reg.) and 10 (Nat.), during which Moiseiwitsch, Joan Cross and Trefor Jones will be heard. John Ireland's "Overture," promised for this concert, has been postponed to September 23rd as the composer is unable to complete the score in time.

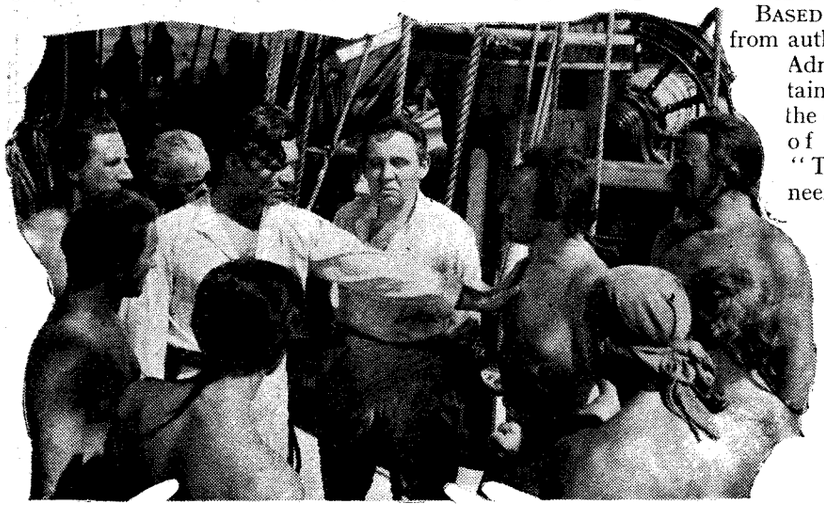
Monday's relay at 8.35 (Nat.) is from the "Valkyrie." Oda Slobodskaya and Parry Jones will be heard in the love duet in Act I, Scene III. The orchestral piece will be "The Ride of the Valkyries," followed by Horace Stevens singing in "Wotan's Farewell and Magic Fire Music."

Rubenstein will play John Ireland's pianoforte concerto in Tuesday's broadcast at 8.20 (Reg.), From Wednesday's Bach concert at 8 (Nat.) will be heard the Brandenburg Concertos Nos. 1 and 4, and Harriet Cohen playing Bach's Pianoforte Concerto No. 5.

Albert Sammons plays Mozart's Violin Concerto No. 3 in D during Thursday's broadcast to be broadcast at 8.35 (Reg.).

NOAH BEERY

WHAT better part could be found for Noah Beery than that of a sergeant-major when one remembers his performance as the bullying sergeant in the film "Beau Geste." Val Gielgud has written a play specially for him in the leading rôle of which he is a sergeant-major. The play, "Sergeant-Major," is a thrilling melodrama of the Foreign Legion, and the action takes place in Spanish Morocco at the present time. It will be broadcast Regionally at 8 on Monday and Nationally at 8.55 the next evening.



THE MUTINEERS. A scene from the Metro-Goldwyn-Mayer film "Mutiny on the Bounty," with Charles Laughton, as Capt. Bligh, in the centre. The play on Wednesday deals with the trial of the mutineers.

COUNTY CRICKET

ON Saturday, Monday and Tuesday from 1.10 to 1.30 and 4.55 to 5.15 (Nat.) commentaries will be given on two County Championship matches. P. G. H. Fender, the famous Surrey captain, will be at Gloucester and describe the game between Gloucester and Notts, while C. B. Fry from Lord's will comment on the Middlesex-Surrey game.

"THE BOUNTY MUTINEERS"

BASED on material collected from authentic sources such as Admiralty records, Captain Blyth's Log, and the contemporary journal of James Morrison, "The Bounty Mutineers," by Owen Rutter and Cyril Nash, should make a very dramatic radio play. This is to be broadcast at 8.30 on Wednesday (Reg.).

"SNAPPY" AND "HAPPY"

THESE are the names of two song-writers in the broadcast to-night (Friday) at 9 (Nat.) entitled "Snappy and Happy take a stroll through Tin-Pan Alley." The programme has been devised and written by Michael Carr, of "Red Sails in the Sunset" fame, and Harry Saville. A number of composers will be taking part, including Jimmy Kennedy, Tolchard Evans, Harry Leon and Hamilton Kennedy. Production is in the hands of A. W. Hanson, and some of the numbers will be played by Harry Saville and his Band who, by the way, is no relation to the joint author of this programme.

A SERIAL THRILLER

EPISODE ONE of a new 5-part thriller to be given on five successive Saturdays will be broadcast at 8 (Nat.) to-morrow. "The Full Story" is the title given to this serial by the collaborators, John Watt and Henrik Ege ("Egg"). The story is built around a dance band, and, as this episode includes a death sentence and several subsequent mysterious killings, it should not be lacking in hair-raising excitement. John Watt plays the part of an intrusive newspaper man who, in his quest for sensational news, bites off more than he can chew. The supporting cast includes Vera Lennox, C. Denier Warren and Henry Oscar, together with Harry Bidgood and his Orchestra.

the Week

Outstanding Broadcasts at Home and Abroad

HENRY AINLEY, who, with Sir Hamilton Harty at the piano playing Richard Strauss's musical interpretation, will recite Tennyson's "Enoch Arden" to-night at 9.0 (Reg.).

RADIOLYMPIA

THREE broadcasts from the Theatre at the Olympia Radio Show are to be given this week, two of which are in the Children's Hour at 5.15 on Monday and Tuesday. At 6.30 on Monday (Nat. and Reg.) the second variety relay from Olympia will be given lasting three-quarters of an hour. In this broadcast will be heard Clapham and Dwyer, the Carlyle Cousins, Harry Hemsley and Mario Lorenzi.

THE PLAGUE

WHILST the Great Plague was raging in London in 1665 some clothing was sent from London to the small Derbyshire village of Eyam. The clothing was infected, and soon the whole village was in the grip of the plague. The Rector of Eyam, William Mompesson, took command of the situation and declared Eyam a "closed port" in order to stop the Plague spreading. By 1666, when the danger was past, 259 out of just over 300 parishioners had died, and among them Catherine, the Rector's wife, he having survived. This story forms the subject for the play, "Plague at Eyam," by Phyllis Crawford, of Idridgehay, Derby, which is being broadcast at 9 on Sunday (Reg.), the day of the annual open-air commemoration service for those who died.

OPERA

A FAIRLY full week of opera commences with the 8.20 Bucharest transmission to-night (Friday), when Verdi's three-act "Rigoletto," which, although on records, is by the distinguished cast of La Scala, Milan. Radio-Toulouse chooses the ever-popular Puccini for its usual 9.10 programme this evening, a concert version of his "Tosca" being presented. Saturday brings a fuller interpretation of this composer's works, for at 8 Monte Ceneri transmits his four-act "Manon Lescaut." This also is a recorded performance from La Scala.

Paris PTT and many of the French stations, in addition to Sottens, will relay at 8.15 the Vichy performance of Donizetti's "Lucia di Lammermoor." This opera has always possessed peculiar attraction for English audiences, probably because the libretto is after our own Sir Walter Scott.

Hamburg at 8.10 on Tuesday relays Wagner's little-known opera, "Das Liebesverbot," from Magdeburg.

OPERETTA

A VARIATION from the usual "straight" performance is included in the 8 o'clock programme from Berlin to-night (Friday), when a musical play, "Wer uns getraut," based on Johann Strauss's operetta "The Gipsy Baron," will be given. This is taken from a public performance staged at the Radio Exhibition in Berlin. On Saturday, Radio Toulouse will be giving a concert version of "White Horse Inn" (Stolz-Benatzky) at 9.10.

IN MEMORY

FROM Stuttgart at 10.40 on Tuesday a concert will be devoted to the works of Frederick the Great of Prussia and his sister. This is in memory of the 150th anniversary of his death, which took place on August 17th, 1786.

GERMAN RELAY FROM AUSTRIA

THE first occasion of a relay from Austria by German stations since the change of *régime* in Germany three years ago takes place on Monday from Stuttgart at 7, when Beethoven's "Fidelio" will be relayed from Salzburg.

DANISH VARIETY

THE first Danish Radio Cabaret to be given before an audience will be broadcast from Copenhagen's Concert Hall studio from 8-11 on Tuesday. This should be worth tuning in.

CLAPHAM AND DWYER who will be heard during the variety broadcast from Olympia on Tuesday.

MISCELLANY

FROM Breslau at 9.15 on Wednesday comes a programme entitled "The Soul of a Woman."

A famous Hungarian gipsy orchestra, Lilli Gyenes and her 20 Gipsy Girls, will be heard from the Swedish stations from 8.10-8.50 on Wednesday.

"Hardly credible, but true," is the title given to a programme on curious meetings and happenings to be given at 9.40 by Hamburg on Thursday.

THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, AUGUST 28th.

Nat., Gliding: talk by Naomi Heron-Maxwell. 8, Prom. 9, "Snappy and Happy."
Reg., Chess Masters at Nottingham. 9, "Enoch Arden." ¶Violin Recital; Max Rostal.
Abroad.
Strasbourg, 8.30, "Die Teresina," operetta (Oscar Strauss).

SATURDAY, AUGUST 29th.

Nat., 6.30, Jean Melville in fifteen minutes of rhythmic melody. 8, "The Full Story." 8.45, Variety. 10, Prom.: Part II.
Reg., 8, Prom.: Part I. 10.30, Billy Cotton and his Band.
Abroad.
Monte Ceneri, 8, Puccini's "Manon Lescaut."

SUNDAY, AUGUST 30th.

Nat., 5.20, Chamber Music: John McKenna (tenor) and The Philharmonic Ensemble. 6.45, B.B.C. Orchestra (C) and Alice Moxon (soprano).
Reg., 6.45, Recital: Henry Cummings (baritone) and Beatrice Harrison ('cello). 9, "Plague at Eyam." ¶Sonata Recital: Albert Sammons and William Murdoch.
Abroad.
Leipzig, 8, "Central Germany," Folk Music Ensembles and Choirs from the Radio Exhibition.

MONDAY, AUGUST 31st.

Nat., 6.30, Radiolympia Variety. ¶Joe Loss and his Band. 8.35, Prom.

Monday, Aug. 31st (*continued*).

Reg., 8, "The Sergeant-Major." ¶Stanelli's Bachelor Party.
Abroad.
Eiffel Tower, 8.30, Symphony Concert.

TUESDAY, SEPTEMBER 1st.

Nat., 7.30, Paul Whiteman and his Band relayed from America. 8, "Light Fare," Variety. 8.55, "The Sergeant-Major."
Reg., "Oysters": talk by E. G. Boulenger. 8.20, Prom. ¶Eddie Carroll and his music.
Abroad.
Frankfurt, 8.10, "Pass-word: Joy!" Variety from the Kursaal, Bad Kreuznach.

WEDNESDAY, SEPTEMBER 2nd.

Nat., Sandy Powell's Album. 8, Prom. 11.5, Walker Cup Commentary.
Reg., 8, "Strictly Confidential," Half-hour's Variety. 8.30, "The Bounty Mutineers."
Abroad.
Kalundborg, 9.10, Italian Opera Music.

THURSDAY, SEPTEMBER 3rd.

Nat., 7, "The Street Singer." ¶Sandy Powell's Album. 11.5, Walker Cup Commentary.
Reg., Music from the Movies. 8.35, Prom. 9.40, Military Band with Watcyn Watcyns (bass).
Abroad.
Leipzig, 8.10, "Joy's Rhythm," dancing and light music.

London's TELEVISION

THE OTHER END OF THE PICTURE

Visitors to the Olympia Radio Show who see there the demonstrations of television reception from the Alexandra Palace will be interested in this description of the arrangements at the transmitting end. Some account of the television transmitters will, it is hoped, be included in a future issue.

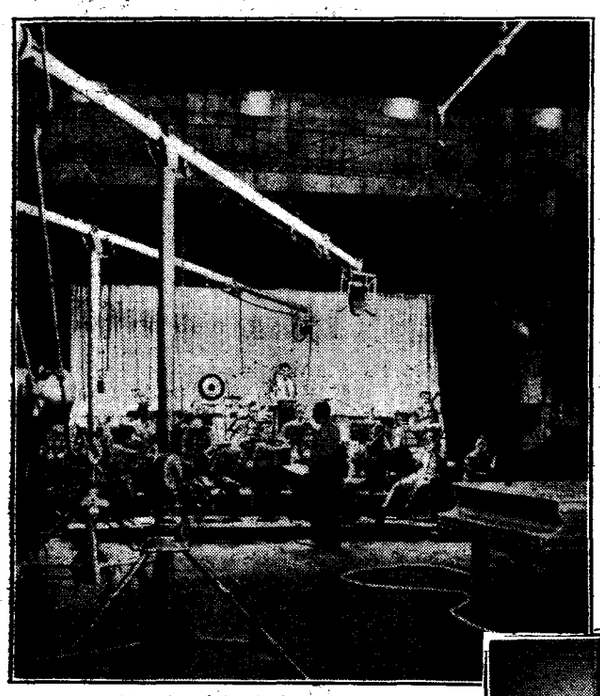
FROM a hill 306ft. above sea level the B.B.C.'s new television station dominates London and a large portion of the Home Counties. It is built into the south-eastern corner of Alexandra Palace—a North London landmark and pleasure resort for more than sixty years—and from the large bay windows of the upper offices below the aerial nearly all London can be taken in at a glance. The importance of height in this connection can hardly be over-emphasised, for under normal conditions the range of the ultra short waves used for television is extended as the height of the transmitting aerial is increased.

Surmounting the reconstructed east tower, itself 80ft. high, is the tapering lattice mast rising to a height of 220ft. Thus the aerial array for vision transmissions, which is mounted at the summit of the mast, is more than 600ft. above sea level. Immediately below the vision aerial is the aerial for the accompanying sound transmissions.

The new station fulfils the recommendations of the Television Advisory Committee appointed to consider the development of television in Great Britain. Provision has accordingly been made for alternate experimental transmission by the systems developed by the Baird Television Company and the Marconi-E.M.I. Television Company respectively. Each company has provided a complete television system, including both vision and sound pick-up apparatus and the television transmitter itself. The B.B.C. has been responsible for the sound transmitter and its associated aerial, both of which were manufactured by Marconi's Wireless Telegraph Company.

In its main essentials, therefore, the equipment comprises a television studio for each system, with an associated control room and ultra short wave television transmitter; and, in addition, an ultra short wave sound transmitter common to both systems.

To these bare necessities, however, much has been added to provide, in the words of the Television Committee, "an extended trial of two systems, under strictly comparable conditions, by installing them side by side at a station in London where they should be used alternately—and not simultaneously—for a public service." Provision has been made for the comfort of artists in the shape of dressing rooms and a restaurant, for staff accommodation, for the viewing and editing of films in a miniature cinema, for the storing of properties and scenery, and for many other adjuncts necessary to a smooth-working programme service. Practical experience during the next few months will doubtless disclose gaps in the existing equipment, but the station, as it now stands, constitutes the first step towards the creation and radiation of television programmes.



An instantaneous television camera seen in action on the right of the Marconi-E.M.I. studio shown above. A portion of the Baird control room is seen in the right hand photograph.

The ground-floor corridor houses the three transmitters, projection theatre, restaurant and scenery productions shop. Nearest to the entrance hall is the Marconi-E.M.I. television transmitter which, like its Baird equivalent, operates on a frequency of 45 megacycles per second (wavelength 6.67 metres).

The Sound Transmitter

Next is the sound transmitter hall which accommodates an ultra short wave installation of orthodox design for radiating speech and music accompanying the vision signals of both Baird and Marconi-E.M.I. systems. Its operating frequency is 41.5 megacycles per second (wavelength 7.23 metres).

Between the sound transmitter and the Baird plant is the film projection theatre, or miniature cinema, in which film excerpts can be selected and timed for inclusion in the transmissions. At least thirty people can be comfortably accommodated.

Our artist re
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The intermed
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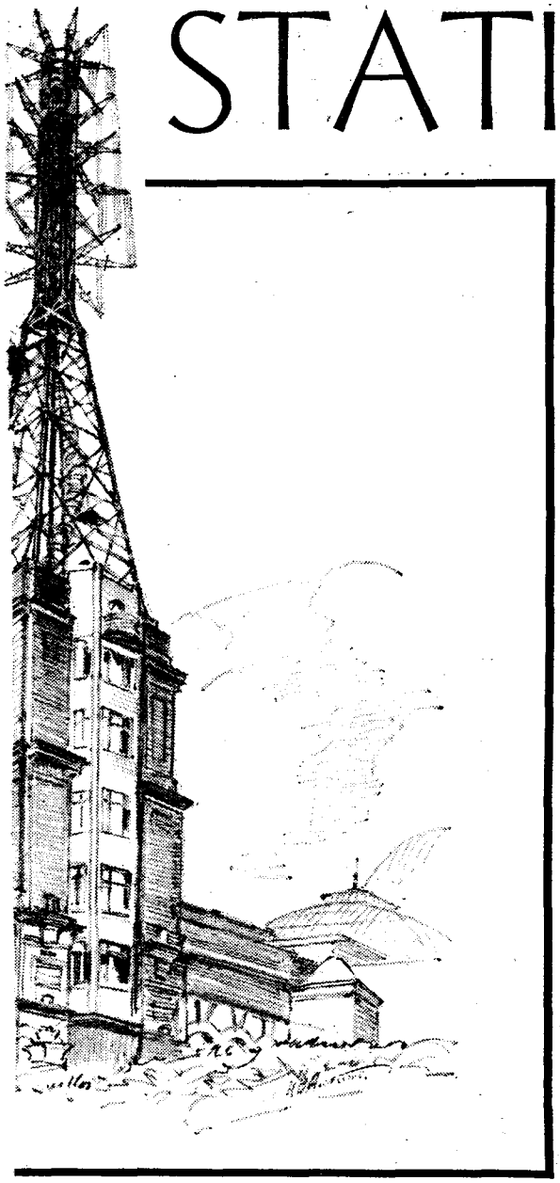
STATION



The Baird transmitter hall, with its control panel and array of generators and amplification stages, is at the south-west end of the corridor. Beyond this, at the south-west extremity of the B.B.C. section of the Palace, is a large area intended either for scenery construction or for televising such objects as motor cars and animals which cannot be brought into the studio or televised outside.

An interesting feature at this point is the ramp or sloping runway down which the television camera can travel to a concrete "apron," approximately 1,700 sq. ft., on the terrace outside, forming a platform for televising open-air performances or special experimental programmes.

Studios

On the second floor is the Marconi-E.M.I. studio. Measuring approximately 70ft. by 30ft., with a height of 25ft., this studio is divided into two stages—A and B—of which A, the larger, gives an acting area of approximately 24ft. square. It is equipped with two sets of tableau curtains. Lining the studio on two sides are hanging velvet curtains running on two tracks, the front curtain being black and the back one white to allow for interchange of backgrounds. Each stage has separate lighting, controlled from a central switchboard. Emitron instantaneous television "cameras" are used.

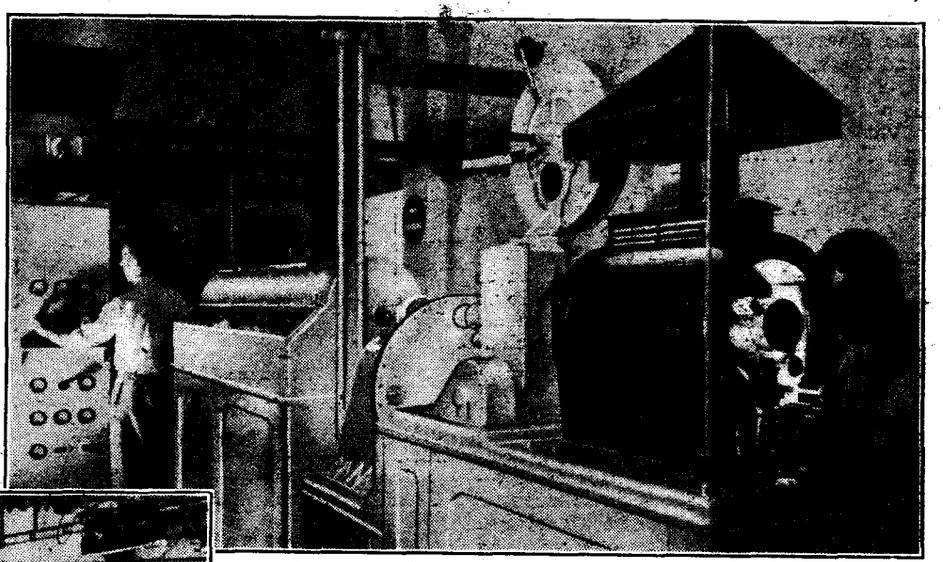
Across the middle of the studio runs a steel lighting bridge which will allow additional lights to be trained on either stage.

High up in the west wall a large plate-glass window indicates the position of the control room, where the producer and the engineering assistant operate. The floor is covered with thick black linoleum and the walls are acoustically treated with an asbestos compound.

Transmitting an outdoor view with a Marconi-E.M.I. instantaneous "camera."

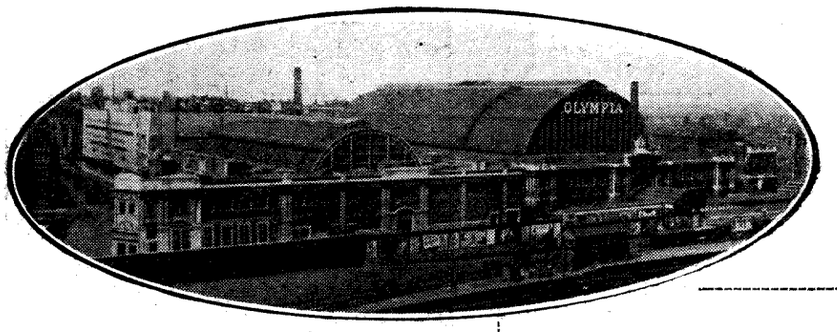
Next to the control room, already mentioned, is the Marconi-E.M.I. tele-ciné room containing two projectors and scanning cameras for televising films.

Leaving the M.-E.M.I. "territory," the Baird tele-ciné room comes next. It also is fitted with two projectors and the necessary equipment for film transmissions. Next to this room is an additional small studio to be used with the Baird Company's "spot light" system of direct television of three-quarter length portraits such as would be required for announcements and talks.



Baird tele-ciné scanner and control rack.

The main Baird studio is the same size as its M.-E.M.I. counterpart. The floors and walls are of similar construction, but the arrangement of the stages is different. The larger stage is placed diagonally to the intermediate film camera room, which is situated in the centre of the studio and looks rather like a bay window of a modern villa viewed from without. The curtains are the same as in the Marconi-E.M.I. studio, but the hanging arrangements differ in that they have to suit the different position of the two stages.



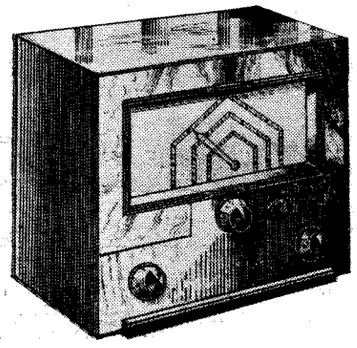
OLYMPIA

AUGUST 26th to SEPTEMBER 5th
11 A.M.—10 P.M. DAILY

STAND-TO-STAND GUIDE TO THE EXHIBITS

AERIALITE (9)

Aerial wires and complete aerial systems of all types, including motor-car aerials and di-pole aerial kits for short-wave reception, constitute the principal business of this firm. New lines appearing for the first time this year include eliminators, trickle chargers, watch-type meters, and a "Multimeter" for AC and DC tests at 12s. 6d. There are



Aerialite No. 2 short-wave convertor.

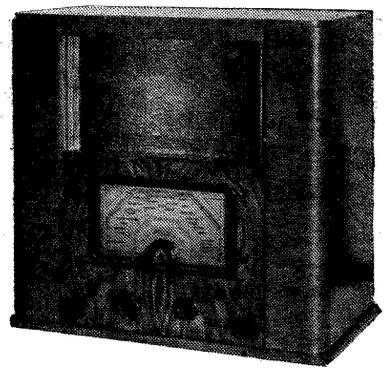
also two new short-wave adaptors of the autodyne oscillator type. No. 1 at £2 7s. 6d. has a wavelength range of 16-52 metres, and No. 2, with two waveranges (13-27 and 27-85 metres) and a special slow-motion dial, is priced at 3 guineas.

Aerialite, Ltd., Junction Mills, Whittington Street, Ashton-under-Lyne.

AERODYNE (74)

A very comprehensive choice of receiving sets for every purpose is offered by this firm. Special attention has been given to battery-operated receivers, and there are no fewer than four models of this type. Model 49 is a "straight" three-valve set, including a short-wave band from 18-50 metres, and is priced at 7 guineas. Model 51 employs the same type of circuit, but has a short-wave range extending from 16.5-50 metres. A band-pass filter utilising iron-cored coils is used on the broadcast wavebands, and the cabinet is of special acoustic design. The price of this model is 8 guineas. Model 50 is a superheterodyne covering medium and long waves, and has a very comprehensive specification which includes automatic volume control and a QPP output stage. The price of this model is £9 19s. 6d. The battery range is completed by the Model 59 at £6 16s. 6d., which is a simple three-valve "straight" receiver for the normal broadcast wavelengths.

Among the mains receivers the Model 54 may be singled out as of special interest. It is an all-wave superheterodyne including a short-wave range from 16.5-50 metres. The circuit includes a stage of HF amplification preceding the triode-pentode frequency-changer. A special feature of this set, the price of which is 13 guineas, is the "Spear-o-lite" tuning indicator. There are also a number of "straight" all-wave and normal broadcast mains receivers, most of which are available either for AC or universal mains operation. Finally, there is



Aerodyne Model 54.

the Model 47 de luxe radio-gramophone incorporating the Aerodyne self-tuning remote control system.

Aerodyne Radio, Ltd., Aerodyne Works, Tottenham, London, N.17.

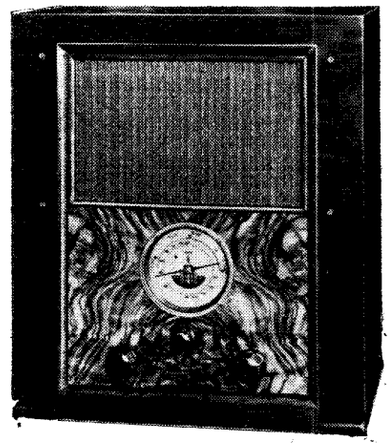
ALBA (41)

All-wave sets are prominent on the Alba stand this year. A popularly priced receiver is the Model 870, which embodies iron-cored coils in signal-frequency and IF circuits. This set costs 11 guineas for AC or 12 guineas for AC/DC. A rather more ambitious receiver is the Model 850, which embodies a second IF stage.

Listeners who confine their attention to the normal broadcast bands are catered for by a superhet at 9 guineas for AC and 10 guineas for AC/DC; again, iron-cored coils are fitted throughout. The same chassis is available as a "Lowboy" console or as a radio-gramophone.

Two-circuit and three-circuit straight battery receivers are also produced, the more ambitious chassis being available both as a table model or as a radio-gramophone fitted with a Garrard double-spring motor.

A. J. Balcombe, Ltd., 52, Tabernacle Street, London, E.C.2.



Alba all-wave mains superhet with 2 IF stages.

ALL POWER TRANSFORMERS (206)

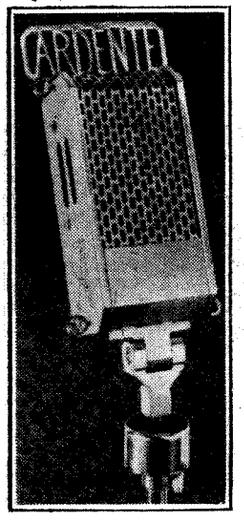
Mains transformers and smoothing chokes form a large portion of this exhibit, but both output and intervalve transformers are also represented in addition to PA equipment and amplifiers. High-voltage transformers for cathode-ray and television apparatus are shown, and a special feature is made of transformers constructed to a tropical specification.

All Power Transformers, Ltd., 8a, Gladstone Road, Wimbledon, London, S.W.19.

ARDENTE (3)

Sound reproducing equipment of every description is shown on this stand.

Two items of outstanding interest are a new Dynamic Ribbon Microphone costing 15 guineas and an automatic sound compressor and expander unit which can be incorporated in all Ardente amplifiers. Its principal function is to give correct balance to the reproduction, although the source of input may be deficient in either treble or bass or



Ardente Dynamic Ribbon Microphone.

SHOW REPORT

Each year "The Wireless World" compiles a full report of the Radio Show, in which the exhibits on individual stands are described. It is hoped that this review will be found a useful guide for visitors to Olympia, and that it will also serve as a permanent record of the activities of the British Wireless Industry for the season.

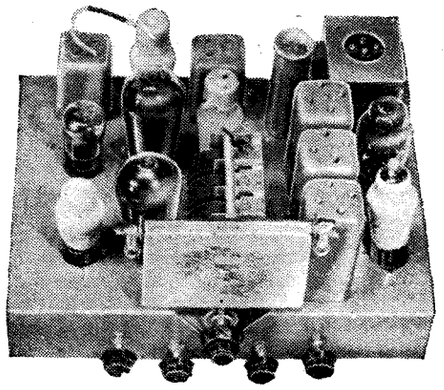
both. It will maintain a constant level of output with widely different sound intensities at the microphone, while the amount of correction can be varied over a wide range.

Rack-built amplifiers are shown for permanent installation, while for mobile work there are several portable self-contained units. Radio units for use with Ardente amplifiers are also included, together with a wide range of deaf-aid amplifiers and appliances.

"Ardente" Acoustic Laboratories, 11-12, Pollen Street, London, W.1.

ARMSTRONG (224)

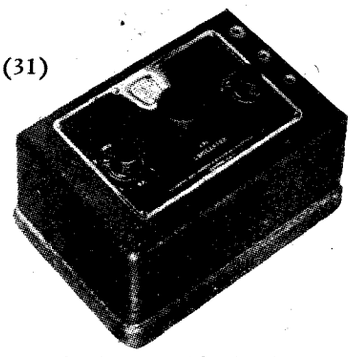
The exhibit of this firm consists of receivers in chassis form, and no fewer than six are all-wave models. An eight-valve set covers four wavebands and has a push-pull output stage fed from a transformer having a loaded secondary. Other models are available using push-pull resistance-coupled LF amplification, and one of these, covering the normal broadcast bands, is priced at £8 10s.



Armstrong all-wave receiver chassis.

Armstrong Manufacturing Co., Ltd., 100, King's Road, Camden Town, London, N.W.1.

AVO (31)



New Avo Oscillator.

The latest addition to this firm's series of test apparatus is a capacity meter, which, although a precision-type instrument capable of giving a high degree of accuracy, is yet simple to operate. Measurements are made at radio frequency and a visual indication of resonance is employed. Direct reading scales calibrated up to 0.1 mfd. are fitted and measurements can be made to within 2 m-mfds. up to 200 m-mfds. and to within less than one per cent. up to 0.01 mfd. It is battery-operated and costs £21.

There is a new model AVO oscillator in very compact form for serviceman's use costing £5 10s. and a more elaborate test set in the form of a signal generator which covers short, medium, long and also IF wavelengths. Its price is £15 15s.

This firm is showing also the range of Avometers retained this year in the same form, but there is a new model for engineers having 46 ranges.

Automatic Coil Winder & Electrical Equipment Co., Ltd., Winder House, Douglas Street, London, S.W.1.

BELLING-LEE (98)

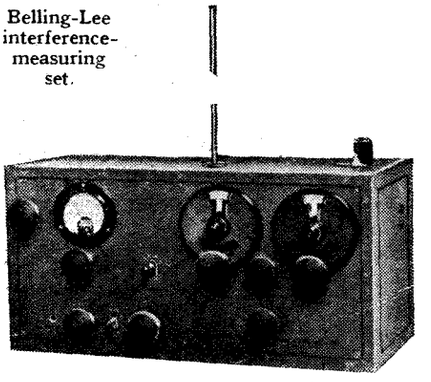
For the present season the activities of Belling and Lee are largely devoted to the manufacture of interference-suppressing devices. One of the most recent introductions is the Eliminoise anti-interference aerial, which is effective on the short, medium and long wavelengths, and which introduces no serious loss of signal strength at any frequency—even on the short waves. By using extra line-to-receiver transformers up to ten sets may be fed from a communal aerial without mutual interaction.

Two new set-lead suppressors (for inserting between the power socket and the receiver) have been introduced. Type 300 is an all-wave model claimed to be effective between 10 and 2,000 metres, and, as it is designed to carry 1 amp., should be suitable for the largest receiver or radio-gramophone. The second suppressor, Type 305, is primarily designed for export, as it covers the 10-600-metre band.

A number of devices for suppressing interference at the source are shown, including a new flex-lead suppressor for use with an appliance wired with three-core cable.

Belling-Lee are now building noise-measuring apparatus to Post Office specification. One of these instruments measures interfering voltages at the mains or at the terminals of an appliance as well as interference field strength, and is thus suitable for determining the effectiveness or otherwise of suppressor devices. There is also a collection of the many connectors for all purposes for which the firm is so well known. Spring terminals, similar in appearance to those of the screw type, but, of course, much quicker in operation, have been introduced.

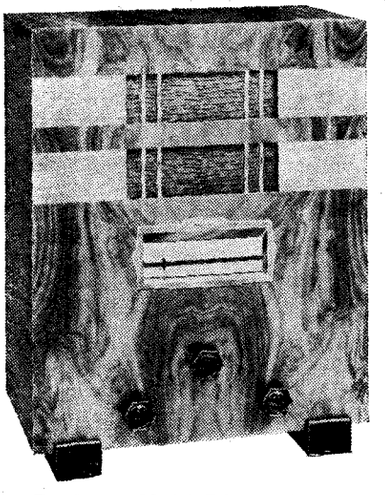
Belling-Lee interference-measuring set.



Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

BEETHOVEN (34)

With few exceptions the receivers shown on this stand are portable and transportable. One of the largest of these is the Model 88; it is a superheterodyne with a built-in frame aerial and a signal-frequency amplifier. A QPP output stage is used and the set is priced at 15 guineas, including batteries. A smaller set is the Model 63 at £7 19s. 6d. This is a table set for battery operation of



Beethoven Model B63 receiver.

Olympia Show Report—

the HF, detector, pentode type with band-pass tuning.

Among the mains-operated sets is a radio-gramophone of the superheterodyne type. This has a frequency-changer followed by one LF stage, a duo-diode detector, and a triode feeding a pentode output valve. QAVC is fitted.

Beethoven Radio, Ltd., Chase Road, North Acton, London, N.W.10.

BRIDGER (211)

Once again this stand is devoted to a display of seamless, moulded paper diaphragms, and many new types have been added, including miniature diaphragms for moving-coil microphones.

R. O. Bridger & Co., Ltd., No. 4 Factory, Shelford Place, Church Street, London, N.16.

BRITISH G.W.Z. (69)

This firm is showing a comprehensive range of dry cell batteries, of which those designed for HT supply are probably the most interesting. These are made in no fewer than forty-eight different types, so chosen that they make suitable replacements for about 300 receiving sets. A list showing the appropriate type is available.

British G.W.Z. Battery Co., Ltd., Falmouth Road, Trading Estate, Slough, Bucks.

BRITISH N.S.F. (96)

The activities of this firm are devoted to the production of resistances and condensers for set makers and the trade generally. Tubular condensers as well as semi-dry electrolytics in many different styles are shown, together with a wide range of fixed and variable resistances.

A special feature is made of a new pattern fixed condenser described as the Silvered mica type. It is made in all capacities up to 0.001 mfd. and is very small and light.

British N.S.F. Co., Ltd., Waddon Factory Estate, Croydon, Surrey.

BRITISH TUNGSRAM (33)

Receiving valves of all types are the exhibit of this firm. Indirectly heated HF pentodes with cathodes consuming 0.65 ampere at 4 volts and with "top-grid" connections are shown. These are the VP4B and SP4B valves, which are rated for operating with the same voltages applied to both screen and anode. Similar valves are available with heaters consuming 0.2 ampere at 13 volts, and, in fact, a whole range of such valves, which are suitable for AC/DC and car sets, is shown.

A new battery valve is the PP225. It is a pentode designed for a 135-volt H.T. supply and consuming 18 mA with a bias of 12 volts. It requires a load impedance of 6,000 ohms and is rated for an output of 800 milliwatts at 7 per cent. distortion.

British Tungsram Radio Works, Ltd., West Road, Tottenham, N.17.

BULGIN (1)

There are so many new and interesting components on the Bulgin stand this year that it is more difficult than usual to single out a few for mention here.

Additions have been made to their series of tuning coils and a new four-waverange unit covering short, medium and long waves has been introduced for use in superheterodynes with an IF of 465 kc/s. Variable condensers in 0.0005 mfd. sizes are shown this year. Known as the "P" type, they are sturdily made and are fitted with trimmers. A two-gang model costs 12s.

There is a series of slow-motion dials with wavelength-calibrated scales which are made in two types. One is square and the other circular in shape. Double-ended pointers are fitted and the scale is protected by a glass front. The CV5 model, which is described as a Square Clock Face dial, costs 10s. 6d.

Self-rectifying Electronic Vibrator made by Bulgin.

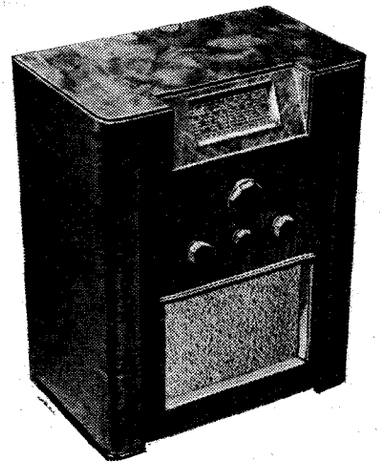
A component of more than usual interest is a new self-rectifying Electronic Vibrator for generating HT from a 6-volt battery. It gives 250 volts of smooth DC and 60 mA can be taken from it. Assembled in a cylindrical metal case, with base pins to fit a standard valve holder, it costs 20s. With it is shown a special transformer and an LT smoothing choke.

There are some new dry electrolytic condensers in aluminium cases which are made in dual capacities, i.e., 8+4 and 8+8 mfds. The case is negative and common to both and the positive leads are brought out through the base. They are for chassis mounting.

Many more ultra-short wave parts are shown this year. Air- and mica-dielectric trimmers, an HF choke for use on wavelengths down to 3.5 metres and small coils constitute but a few of the components in this section.

The short-wave section has also been extended and among other items now includes a doublet aerial kit.

A. F. Bulgin & Co., Ltd., Abbey Road, Barking, Essex.



Burgoyne "straight" all-wave AC set.

BURGOYNE (75)

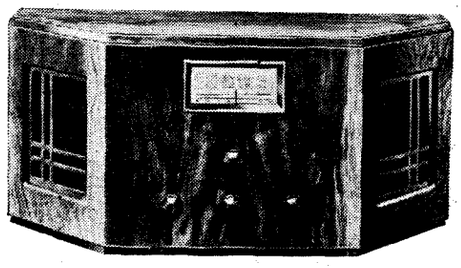
This firm has now entered the all-wave field with two models—a superhet and a "straight"; both cover wavelengths from 19 metres upwards. The superhet embodies several unusual features, and is designed to avoid the usual uncertainty about the identification of stations on the short-wave band. There is also a three-position selectivity switch giving an optimum band-width for long-distance, medium-distance, and local-station working; this switch automatically changes over the degree of automatic volume control in the "medium" and "local" positions. The straight set, like the superheterodyne, employs Litz-wound, iron-cored coils throughout. The receivers cost 14 guineas and 9½ guineas respectively, while there is a radio-gramophone with straight chassis at 17 guineas.

There are also superheterodyne and straight broadcast-band receivers. All the foregoing are for AC mains, but receivers for batteries and AC/DC supplies are also produced.

Burgoyne Wireless (1930), Ltd., Great West Road, Brentford, Middlesex.

BURNDEPT (65)

Among the receivers shown on this stand the Model 201 is well worth examination. Although externally the same as an older

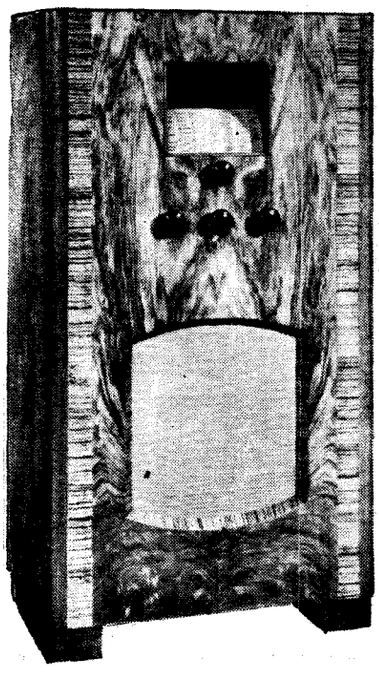


Burndept Model 201 superheterodyne.

product of this firm, the receiver itself is new and is a superheterodyne having a frequency-changer preceded by a band-pass filter. There is one IF valve and a triode detector feeds an output pentode delivering 3½ watts to the loudspeaker. AVC is fitted and the set is priced at 13½ guineas.

The Models 251 and 252 are all-wave sets of the three-valve straight type having two short-wave bands. The former is a battery-operated set costing £7 19s. 6d., while the latter is an AC/DC set. The Model 241 "Attaché Portable" is a three-valve set of the HF, detector, pentode type with ganged tuning controls. It weighs 14¾lb. and costs £5 18s. 6d.

Burndept, Ltd., Light Gun Factory, Erith, Kent.



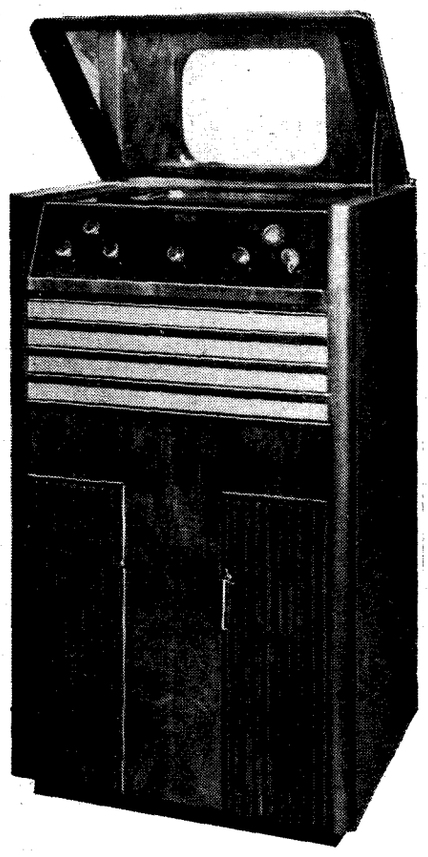
Bush Triode Grand.

Olympia Show Report—

BUSH (50)

Those who prefer the triode output valve to the ubiquitous pentode will be interested in the Bush Triode Superhet, in which an ACO44, rated at 3½ watts, is employed in the output position. This valve is fed from an intermediate LF stage through resistance coupling. For the present season variable selectivity controlled by a three-point switch has been added to last year's design, but the price has been reduced to 13 guineas. A pentode output superhet, also including the feature of variable selectivity, costs 10 guineas.

The latest introduction is the Model SSW37 all-wave superheterodyne embodying an interesting specification which includes a signal-frequency amplifier and a pair of three-circuit IF couplings; again, a triode output valve is used. This set, which is a table model, costs 15 guineas, and is a four-band set giving short-wave coverage from 17 to 53 and 75 to 200



"Televisor" shown by Bush Radio.

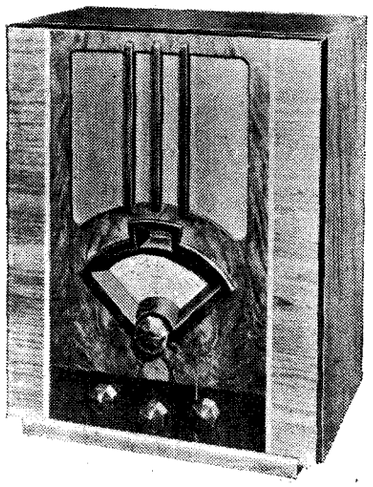
metres. A cheaper model at 11½ guineas omits the higher short-wave range.

Other interesting Bush exhibits are "Televisors," of which two are shown. Model T5 receives 240- or 405-line pictures, and the accompanying sound on frequencies of 38-48 megacycles and 34.5 to 44.5 megacycles respectively. The picture, measuring approximately 12in.×9in., is reproduced on a mirror inclined at an angle of 45 degrees to the cathode-ray tube, which is vertically mounted below a safety-glass window. The various functions of this television receiver are carried out by a total of twenty valves.

Bush Radio, Ltd., Woodger Road, Shepherd's Bush, London, W.12.

C.A.C. (18)

The receivers shown by this firm are superheterodynes. The Austin "Coronation" receiver covers the medium and long wavebands only, and is of the six-valve type, including the rectifier. A triode-pentode frequency-changer is used and is followed by a



C.A.C. Austin "Coronation" receiver.

single IF stage, which, in turn, feeds a duo-diode-triode. The output valve is a pentode and a separate triode valve is fitted for QAVC purposes. The set is priced at 14 guineas.

The Austin "Empire" receiver is an all-wave set having four wavebands and tuning down to 10 metres. The first IF transformer includes three tuned circuits and follows the triode-hexode frequency-changer. One IF stage is used, and a duo-diode-triode provides detection, AVC, and feeds the output pentode. The set costs 16 guineas.

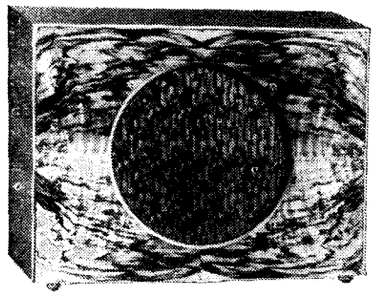
All-wave tuning coils are shown covering 10-2,000 metres in four bands. They are available in kit form with switches and with all trimming and padding condensers.

A special feature is being made of cabinet work and receivers can be supplied in any cabinet style, while cabinets are available to suit an existing receiver chassis.

City Accumulator Co., Ltd., 18-20, Norman's Buildings, Central Street, London, E.C.1.

CELESTION (24)

In addition to a display of the Celestion range of manufacturers' moving-coil units a range of high-grade extension loud speakers is shown on this stand. They include the "Junior 8," "Standard 8," "Senior 9," and "Junior Auditorium" chassis at prices ranging from £1 15s. to £6, and the same units housed in high-grade cabinets at prices from £2 15s. to £7 15s. The "Junior 8" cabinet model is new to this range, and the unit is now fitted with the universal transformer and constant impedance volume control which is a feature of the more expensive models. The "Senior Auditorium" model for public-address work is being continued at 15 guineas in DC form, or 18 guineas complete with rectifier equipment for AC supplies.



Celestion "Junior 8" cabinet model.

Celestion, Ltd., London Road, Kingston-on-Thames, Surrey.

CLIX (82)

Plugs, sockets, terminals and connectors of every description are shown in profusion on this stand. Valve holders now form an important section and a wide variety of types are shown, mainly for chassis mounting.

There are several new models, notably a short-wave pattern mounted on Frequentite and having floating sockets. There is also one of skeleton construction with short legs for baseboard mounting and some midget chassis models for Hivac valves.

Lectro Linx, Ltd., 79a, Rochester Row, London, S.W.1.

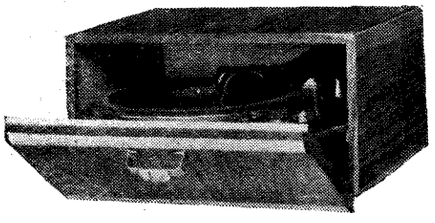
COLLARO (70)

The principal item of interest on this stand is the new record-changer which is designed to play eight 9-inch, 10-inch or 12-inch records arranged in any order. It is available for operation from AC mains at 10 guineas, or fitted with an AC/DC universal motor at £11 16s. 3d. A wide variety of spring and electric motors are also shown, of which the AC37 induction motor and the U36 universal model will probably be of most interest. These motors are also available in complete radiogram conversion units incorporating the No. 36 Collaro pick-up.

Collaro, Ltd., Culmore Works, Culmore Road, Peckham, London, S.E.15.

COSMOCORD (78)

This firm specialises in gramophone equipment and accessories, and new products this year include the Model 84 playing desk at £4 4s., which readily converts any table-model receiver into a radio-gramophone. A pedestal model playing



Cosmocord Model 84 playing desk.

desk at £6 6s. will also be shown in which storage space for records is provided. Prominent among the gramophone components are the Model MF gramo-chassis, comprising an AC turntable and pick-up at 55s., the new Model 250 pick-up at 25s., and a pick-up head designed to fit the tone arms of old acoustic gramophones at the modest price of 5s.

Cosmocord, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

COSSOR (55)

Although a wide range of valves is shown by this firm, receivers occupy a prominent place on the stand and include one all-wave set of an unusual type. This is the Model 3733, a three-valve battery set, which functions as a straight set with one HF stage on the medium and long wavebands, but as a superheterodyne on short waves. Iron-cored coils are used and the set is priced at £7 15s. A similar receiver for AC operation, the Model 3783, costs £9 15s.

A battery superheterodyne covering the

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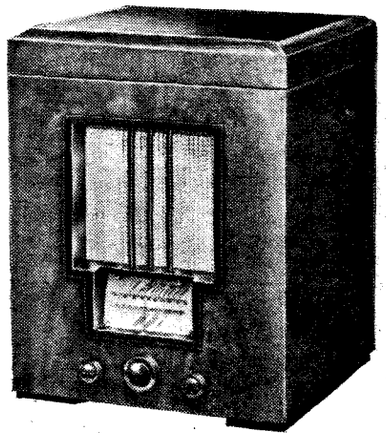
medium and long wavebands is known as the 376B; it has a heptode frequency-changer and one IF stage followed by a duo-diode, driver, and Class B output stage. It costs £8 18s. 6d. Straight sets are also shown and include the Super-Ferrodyne 373, which has pentodes in the HF, detector, and output stages. It is a straight battery set and is priced at £6 15s.

Cathode-ray equipment is shown and includes a linear portable oscillograph which is mains-operated and self-contained with a linear time-base covering a wide frequency range. A larger oscillograph employing a high vacuum tube is also shown, as well as an engine indicator and a cardiograph.

Many different types of cathode-ray tube are to be found and range from small gas-focused tubes for laboratory use to large high-vacuum types for television purposes, both transmitting and receiving. The large television tube, the 3272, has a diameter of 34 cms. and costs 15 guineas.

This tube is employed in the complete television receiver shown by this firm. The receiver is a superheterodyne functioning on



The Cossor Model 737 three-valve battery set.

both sound and vision channels, and it also enables reception to be obtained from stations on the medium and long wavebands.

A. C. Cossor, Ltd., Cossor House, Highbury Grove, London, N.5.

CRYPTON (202)

This firm specialises in apparatus for battery charging, and the exhibit includes charging plants with all types of rectifiers, portable battery chargers, and a wide range of battery-testing apparatus and charging station accessories.

Crypton Equipment, Ltd., North Acton Road, Park Royal, London, N.W.10.

D. M. DAVIES WOODWORK (17)

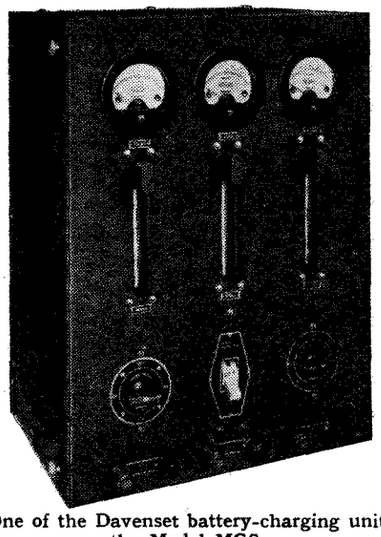
On this stand are shown cabinets of all types and other woodwork primarily of interest to set manufacturers.

D. M. Davies Woodwork, Trading Estate, Slough, Bucks.

DAVENSET (107)

Battery-charging equipment is one of the main activities of this firm and the apparatus shown on this stand is largely in connection with this side of their business. There are small charging sets for AC mains giving 25 volts at 6 amps. for garage use as well as larger sets for handling both LT and HT batteries, one of the latter type being the Model MGC5, capable of dealing with ninety-six two-volt LT cells and 120 two-volt HT cells. It gives 60 volts at 8 amps. divided among four circuits and 300 volts at 300 mA on one circuit. It costs 31 guineas.

An HT charger for AC mains delivering 300 volts at 300 mA is also shown, as well



One of the Davenset battery-charging units, the Model MGC3.

as a range of models for DC supply mains, together with the Davenset Class A mains transformers and chokes.

Partridge, Wilson & Co., Ltd., Evington Valley Road, Leicester.

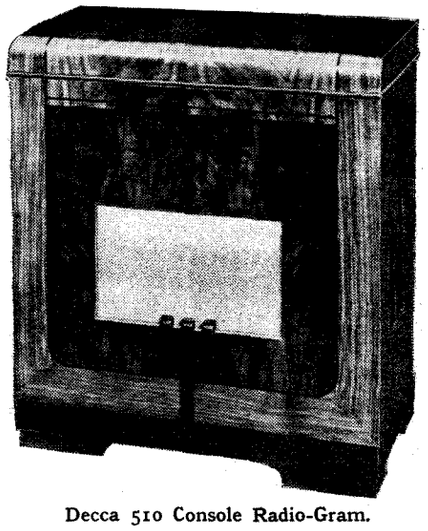
DAVIS & TIMMINS (210)

This firm are well-known manufacturers of screws, nuts and washers with BA and other threads. They also produce terminals, plugs and sockets, and various other small parts used in wireless apparatus.

Davis & Timmins, Ltd., Brook Road, Wood Green, London, N.22.

DECCA (44)

The majority of the receivers shown by this firm are superheterodynes. The Models 520, 530G and 540CG are all-wave sets covering 16-49 metres in addition to the ordinary broadcast bands. These receivers are, in fact, identical, differing only in the gramophone equipment and cabinet work.



Decca 510 Console Radio-Gram.

HF pentodes are used for both the HF and the IF stages with a heptode frequency-changer, and the output valve is also of the pentode type, delivering 3½ watts to the loud speaker. A similar receiver, the Model 510, is a radio-gramophone covering the normal broadcast bands, and priced at 18 guineas. It is fitted with automatic noise-suppression.

The Decca-Brunswick all-wave receiver Type BTA/1 also includes automatic noise-suppression. It has two IF stages and a duo-diode acts as detector and provides AVC. The output valve is a pentode rated for 3.5 watts. A signal-frequency amplifier is included and the short-wave range covers 16-49 metres. As a table model the set costs 18 guineas, but it is also available as a console at 22 guineas.

Decca Gramophone Co., Ltd., 1-3, Brixton Road, London, S.W.9.

DE LA RUE (6)

The ever-increasing importance of plastic materials in wireless technique is illustrated by this exhibit. In addition to the applications of bakelite with which we are already familiar, and which now include such large mouldings as cabinets and smaller accessories, articles moulded by the injection process are shown. These are made in cellulose acetate and in the new Vinyl transparent resin.

Thos. De La Rue & Co., Ltd., 90, Shernhall Street, London, E.17.

DIGGLE (15)

The Reliance range of motor-generator charging sets for use in battery service stations and garages is shown on this stand. Each unit is self-contained, being fitted with a switchboard, meters, regulators and cut-outs in all circuits. This year a charging set driven by a small petrol engine is included.

Alfred Diggle & Co., Jane Street, Rochdale, Lancs.

DUBILIER (39)

In addition to the well-known products of this firm, many new components are shown on this stand. Among these are two ranges of moulded-case mica-dielectric condensers rated for working at 350 volts peak. The Type 690W is available in capacities from 0.0001 mfd. to 0.002 mfd. and has wire connections, while the Type 691 has soldering tags and is supplied in capacities of 0.005, 0.006, and 0.01 mfd.

A new range of paper dielectric condensers with solder-tag connections is shown in capacities from 0.1 mfd. to 4 mfds. They are available in three different voltage ratings, 250, 350 and 650 volts DC, and are claimed to be able to withstand adverse climatic conditions without harm, being free from moisture penetration. Tubular paper condensers are also on view and are rated for 350 volts; they are of new design, giving a higher factor of safety and a greater insulation resistance than the older patterns.

Wet electrolytic condensers in 4 mfds. and 8 mfds. capacities and rated for operating at 450 volts form a portion of the exhibit, as well as dry electrolytic condensers of capacities between 8 mfds. and 50 mfds. rated from 12 volts to 150 volts.

The well-known range of metallised resistances has been extended to include a half-watt series and the range as a whole is now known as Type F. The ½-watt resistances range in value from 50 ohms to 10 megohms and are priced at 6d. Wire-wound resistances, Type BW, are also shown. They are completely insulated and in the half-watt rating can be obtained in values between 0.25 ohm and 500 ohms at 9d. The 1-watt type cost 1s. and the range of values is 0.5-2,000 ohms.

Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.

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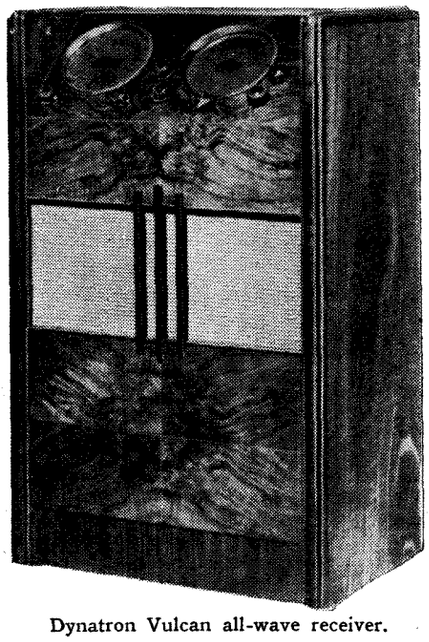
DYNATRON (29)

The receivers shown by this firm are of the straight type and a high standard of performance in the matter of quality of reproduction is claimed. The Viking Model V73 has two HF stages and four tuned circuits using



Dynatron Vulcan all-wave receiver.

iron-cored coils. Variable-selectivity is included and the output of 3 watts is obtained from a triode.

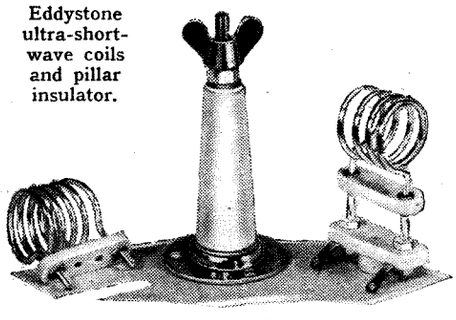
The largest set is the Ether-Empress with three HF stages and a 7-watt amplifier. A short-wave tuner is fitted, thus making the apparatus all-wave, and a total of sixteen valves is used. This short-wave tuner can be employed with the other receivers of this firm and it has a range extending down to 11 metres.

H. Hacker & Sons, Perfecta Works, Ray Lea Road, Maidenhead, Berks.

EDDYSTONE (23)

In addition to showing their well-known range of short-wave apparatus, which includes such components as variable condensers, tuning coils, HF chokes, etc., this firm will have an eight-valve superheterodyne on view. It is built to a tropical specification, and is, of course, a short-wave receiver. AVC is fitted and the output stage is Class A push-pull.

A number of new ultra-short-wave coils has been introduced. These coils are wound with silver-plated 14-gauge wire and are self-supporting, the ends being mounted on a Frequentite strip. A suitable socket, also



Eddystone ultra-short-wave coils and pillar insulator.

of Frequentite, is available. The coils have a diameter of ¾in. and are available in sizes having from 3 to 8 turns at prices up to 1s. 10d.

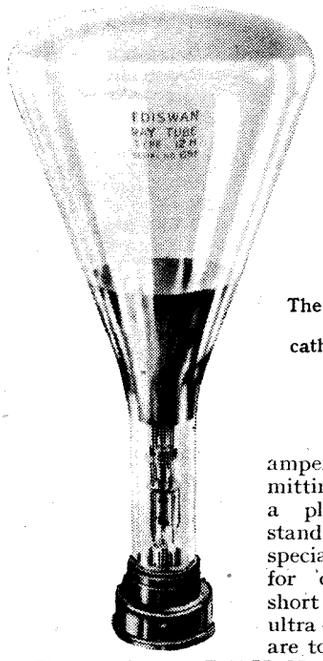
A new Pillar Insulator, tested for breakdown at 30,000 volts, is also on view. It is specially suitable for transmitting work, and costs 1s. 6d.

Stratton & Co., Ltd., Eddystone Works, Bromsgrove Street, Birmingham.

EDISWAN (42)

One of the principal exhibits of this firm is cathode-ray apparatus, among which the 12H tube, designed for television purposes, is of especial interest. It has a screen diameter of 30 cms. and an overall length of 62.5 cms.; it is rated for a maximum operating potential of 6,000 volts, and requires about 1,000 volts for the deflector plates. It needs only 20 volts for modulation, however. Smaller tubes shown are the AH, BH and CH, with screen diameters of 7in., 5in., and 10in., respectively.

A full range of Mazda valves is on view, including HF pentodes with "top-grid" connections and a new output triode. This has characteristics the same as those of the older PP3/250, but in order to maintain mains hum at a minimum the filament is rated for 2 volts only; it consumes 2



The Ediswan 12H television cathode-ray tube.

amperes. Transmitting valves find a place on the stand, and types specially designed for operation on short waves and ultra-short waves are to be seen.

The well-known B.T.H. Needle Armature pick-up is shown, as is also the Minor pick-up, which is priced at 17s. 6d., including volume control. The B.T.H. piezo-electric pick-up has a wide frequency response and is highly sensitive. Complete with tone-arm and pick-up rest, it costs 2 guineas.

Ediswan accumulators and Tungar battery chargers are also on view.

The Ediswan MRAC1 and HEAC1 relays have been withdrawn and replaced by a range of Mazda Thyratrons, of which the T11 and T21 are equivalent to the MRAC1 and HEAC1 respectively. The T31 has similar characteristics, but is argon-filled.

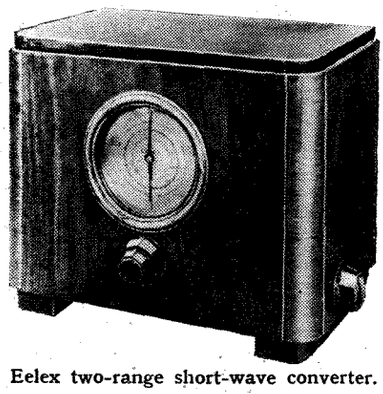
Four 12in. cathode-ray tubes are to be seen working on this stand.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.

EELEX (T24)

In addition to a comprehensive range of proprietary receivers, accessories and components, this firm is showing the full range of Eelex specialities, among which is a series of short-wave converters for mains and battery operation.

A new model has been introduced this year for use with mains sets. It covers a wave-range of 13 to 55 metres in two bands and costs £4 14s. 6d. It is known as the Model A2.



Eelex two-range short-wave converter.

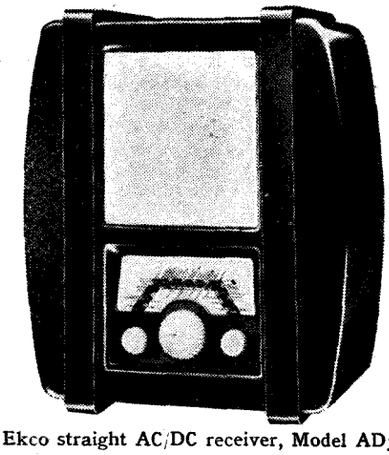
Eastick is showing also a manufactured version of *The Wireless World* microphone made by Gilbert Industries and finished in cream and chrome at the price of 25s.

J. J. Eastick & Sons, 118, Bunhill Row, London, E.C.1.

EKCO (53)

It is something of a paradox that one of the greatest innovations of the season in the battery-set field should come from a firm which is generally associated in our minds with the technique of mains operation. We refer, of course, to the Ekco "No HT" system as employed in a seven-stage superhet which derives its entire power supply from a pair of 2-volt accumulators in series. High-tension current is obtained from the LT cells through a vibratory self-rectifying converter which supplies about 140 volts at 14 mA. The vibrator unit is housed in a shielding case, and associated with it are a centre-tapped step-up transformer, a smoothing filter and an HT filter, while hum due to the converter is prevented by the fitting of a filament choke in the positive lead.

The valve filaments are arranged in two parallel groups, each group being connected in series. The total consumption of filaments and vibrator amounts to 1.4 amps. Bias is, of course, automatic, but otherwise the circuit is fairly conventional; the set costs 12 gns.



Ekco straight AC/DC receiver, Model AD37.

Other interesting receivers are the AC97 nine-stage superhet and the all-wave AW87. It is claimed that the first-mentioned model,

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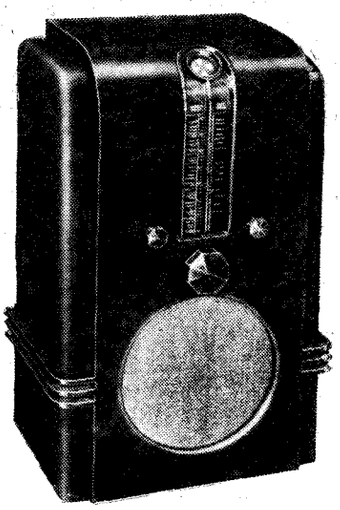
which covers the normal broadcast bands, gives level response from 50-80,000 c/s; a 9-kc/s tuned rejector is fitted, and there are many other refinements, including variable selectivity. Noise suppression is put into operation in an extremely practical way by pressing lightly on the main condenser control knob during the process of tuning; this device, in conjunction with a special form of



Ekco "high fidelity" AC receiver.

indicator, enables a station to be tuned accurately with a completely silent background. It is claimed that second-channel whistles have been entirely eliminated. Considering its extremely advanced design, the receiver appears cheap at 12½ gns.

The Ekco all-wave receiver is a three-band superheterodyne with eight stages, and, like all the Ekco table models, is housed in a bakelite cabinet.

E. K. Cole, Ltd., Ekco Works, Southend-on-Sea, Essex.

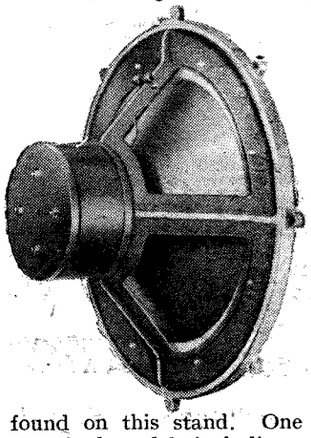
ELECTRON (22)

Materials and fittings for the erection of aerials constitute the exhibit of this firm, and wires of several different kinds are shown. "Electron" braided and compounded copper aerial wire is a recent introduction, and there is also a partially screened aerial of which the lower 20ft. is covered with tinned copper braiding.

New London Electron Works, Ltd., East Ham, London, E.6.

EPOCH (94)

Two notable additions to the "Super Cinema" range of loud speakers will be



Epoch "Super Cinema" PM speaker.

found on this stand. One is the SCH36 energised model, including an AC rectifier, and the other a permanent-magnet model of exceptionally high power-handling capacity. Both units employ 18½-inch diameter diaphragms of the interchangeable type and are fitted with 2-inch speech coils. The power-handling capacity is of the order of 30 watts.

The Models 101½ and D4 have been improved by a new suspension material at the periphery of the cone, and a range of horns has been introduced for use with the D4 and B7 units. With the horn loading the power-handling capacity of the latter unit has been brought up to 20 watts.

The Epoch Model 55 moving-coil microphone has been increased in sensitivity and is now supplied with a new range of stands.

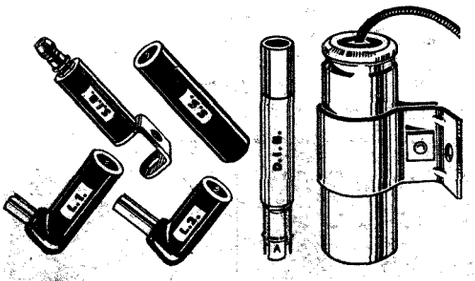
This firm is now entering the component market, and particulars are available of an interesting scheme for servicing sets on a twenty-four hour basis.

Epoch Reproducers, Ltd., Aldwych House, Aldwych, London, W.C.2.

ERIE (16)

Standard Erie carbon resistors in 1-, 2- and 3-watt ratings are shown; though usually made to the degree of accuracy imposed by manufacturers' normal tolerances, resistors with values accurate to within 2½ or 5 per cent. can be supplied.

A more recent type of resistor with the element enclosed in a ceramic insulating tube has obvious advantages in certain cases, particularly in compact receiver assemblies; these are made in ¼-W and ½-W



Erie motor car suppressor devices.

ratings. Wire-wound resistances (which can be tapped) are shown in ratings from 5 W to 100 W.

There are also volume controls, with and without built-in switches, and a series of special interference-suppressing resistors for the ignition systems of petrol engines.

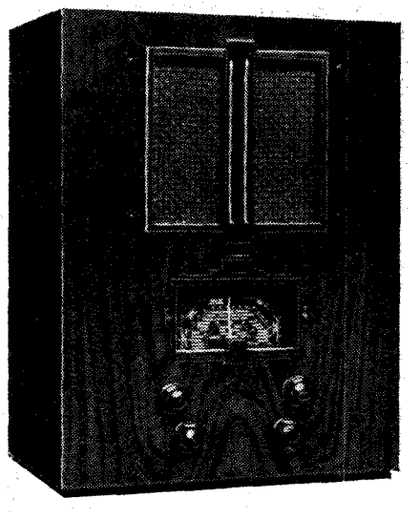
Radio Resistor Co., Ltd., 1, Golden Square, London, W.1.

EVER READY (58)

In the Ever Ready AC Model 5011 continuous short-wave coverage between 13 and 82 metres is given in two steps; medium and long broadcast bands are also provided. This is an unusually flexible receiver, being provided with five separate controls; the specification includes a signal-frequency HF stage. There is also a universal AC/DC all-wave model with a straight circuit and another of the same type for battery operation. A range of receivers, both superheterodyne and straight, for the normal broadcast bands are shown, and in addition there is a battery-fed transportable including four valves and a straight circuit with Class B output.

The Every Ready suitcase portable is externally of conventional design, but the loud speaker, instead of being mounted in the lid in the usual manner, is fitted below a baffle board which automatically rises to the correct angular position when the case is opened. The speaker is of the permanent-magnet type with a 4½-inch cone.

In addition to these receivers, Ever Ready batteries of all types are shown.



Ever Ready universal all-wave Model 5013.

Among the many types of special-purpose batteries, it is possible to find something suitable for almost any requirement.

Ever-Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7.

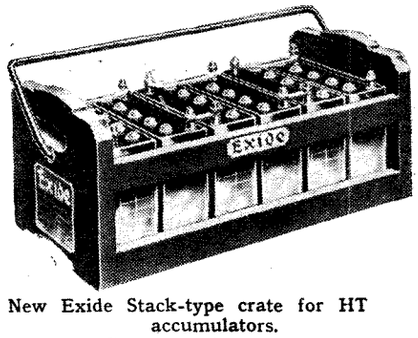
EXIDE & DRYDEX (32)

In addition to showing the full range of standard-type Drydex batteries, this firm have a long list of batteries made to fit all the well-known battery sets in use to-day.

The latest development in the Exide accumulator section is the "Hycap" cell, which has been introduced to meet the demand for an LT battery of reasonable size yet capable of standing up to a comparatively heavy discharge.

It is fitted with more and thinner plates than the Exide "mass" series of batteries and embodies the pointer-type visual indicator. There are four models in the new series, ranging from 15 AH to 60 AH rating; a 25-AH size costs 10s. 6d.

Exide are also showing a new style of wooden crate for holding their HT accumulators. It is known as the Stack-type crate,



New Exide Stack-type crate for HT accumulators.

for two or more are intended to be stacked one above the other, thereby resulting in a considerable saving in floor, or table, space for the HT battery. Detachable metal carrying handles are fitted to all crates.

Heavy-duty multi-plate batteries, unspillable cells and HT accumulators complete a very interesting exhibit.

Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.

FARREX RADIO (218)

Short-wave converters and PA equipment constitute the main interest on this stand.

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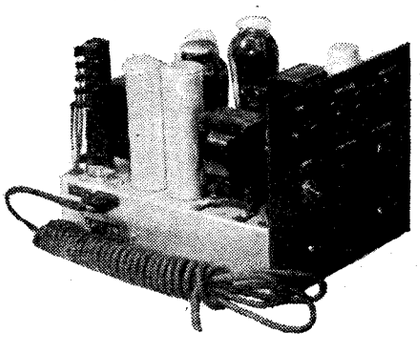
The Model F1 short-wave unit is entirely enclosed in a metal cabinet of striking design and covers 12 to 100 metres. Waveband switching is employed. It contains its own power pack and costs 79s. 6d.

A projector type PA loud speaker, several carbon microphones and a two-stage push-pull amplifier fitted with universal valves are shown together with a series of battery eliminators.

Farrex Radio, Rear of 543, Holloway Road, London, N.19.



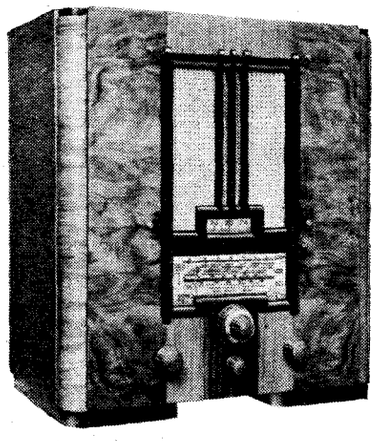
Chassis of Farrex Model FX4 amplifier.

FERRANTI (8, 63 & 216)

With one exception, namely, the "Nova" two-wave AC receiver, all Ferranti sets this year are equipped for short-wave reception. The standard wave ranges are as follows:—19-51, 200-550, and 900-2,000 metres. The "Parva" series employs a "straight" three-valve circuit with pentodes throughout and there are four models, AC and universal, in moulded cabinets at 9 guineas and 9½ guineas respectively, an AC console at 13 guineas and an AC radio-gramophone at 17 guineas. The sets in this series are fitted with the well-known Ferranti centralised tuning dial, but the remaining models have, in addition, the "Magnascopic" dial, which is a clever optical device for producing a magnified scale with an effective length of over 6ft.

The first series to include this feature is the "Nova." The basic circuit is a superheterodyne with a heptode frequency-changer, pentode IF amplifier and double-diode pentode output valve. The price of the standard AC model in a new design of moulded cabinet is 12 guineas, the universal model is 13 guineas, and there is a battery version at 11½ guineas.

The chassis of the two "Magna" receivers is similar to that of the "Nova," but a tuning indicator is included and the cabinet is of wood, finished with veneers of walnut and macassar ebony. The price of the AC "Magna" is 12½ guineas and of the universal model 13½ guineas.



Ferranti "Arcadia" all-wave receiver.

The "Arcadia" all-wave superheterodynes include the refinement of variable selectivity, and all models are housed in walnut cabinets. The receivers are for AC mains only and the table model costs 15 guineas; the console, with controls let into the top panel, 18 guineas; and the radio-gramophone 26 guineas.

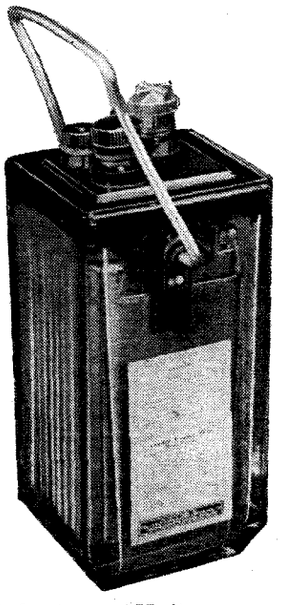
Lastly, there is the "Gloria" radio-gramophone with automatic record-changer which incorporates the "Arcadia" chassis with a 6½-watt push-pull output stage. The price of this model is 52 guineas. A separate small stand is devoted to a display of Ferranti measuring instruments and the exhibit also includes a large selection of radio components such as intervalve transformers, chokes and resistances.

Ferranti, Ltd., Radio Works, Moston, Manchester.

FULLER (101)

Many additions have been made recently to the Fuller Sparta series of dry batteries, and models are now available for all the well-known proprietary sets.

The range of LT accumulators has also been extended; one new model of special interest being the FMG, designed to stand a comparatively heavy discharge yet being of quite reasonable dimensions. Rated at 24 AH it measures 3⅜ by 3⅝ by 7½in. high and costs 10s.



Fuller FMG 24 AH accumulator.

The Mammoth plate series of LT cells for heavy-duty work are shown in various types.

Fuller Accumulator Co. (1926), Ltd., Woodland Works, Chadwell Heath, Essex.

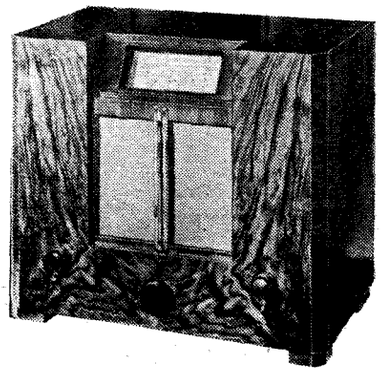
FILM INDUSTRIES (4)

Complete public-address equipment, including amplifiers, moving-coil microphones and the well-known F.I. exponential horns, are shown. There are also two very interesting high-quality domestic loud speakers in the PAC4 and PAC5 units at 4 guineas and £5 15s. 6d. respectively. A wooden horn with a 5ft. flare is available for the latter unit, which increases the power-handling capacity from 10 to 20 watts.

Film Industries, Ltd., 60, Paddington Street, London, W.1.

G.E.C. (40 & 51)

A wide range of receivers is a part of the exhibit of this firm, among which the Fidelity Short-Wave Five is of especial interest, for it covers 16-50 metres in addition to the ordinary broadcast bands. It is a superheterodyne with a triode-hexode frequency-changer and an input band-pass filter. A single IF stage operating at 445 kc/s is used and is followed by a duo-diode-triode, which feeds the output pentode. Variable selectivity is included, and the set is priced at 15½ guineas.



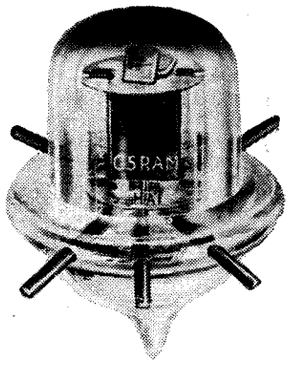
G.E.C. Fidelity Short-Wave Five.

Another all-wave set is the Universal SW4, and, as its name implies, it is designed for AC/DC operation. It is a superheterodyne with an intermediate frequency of 125 kc/s, and it costs 12½ guineas. The Battery Super 4 is also a superheterodyne using a heptode frequency-changer and covering the ordinary broadcast bands.

Two G.E.C. television receivers are also shown; these are described in full on p.235.

A considerable number of new Osram valves is shown, among which the eye of the short-wave enthusiast will be caught by the HA1 Acorn. This is a triode of minute dimensions intended for operation at very short wavelengths, of the order of 1 metre or less. It has a mutual conductance of 1.7 mA/V and a resistance of 11,800 ohms. A new low-resistance diode, the D42, is also to be found, as well as a range of valves having heaters rated at 4 volts 0.6 ampere. These are a triode H42, an HF pentode W42, and a heptode X42; all have "top-grid" connections and are supplied non-metallised.

There is a new rectifier, the U18, with an output of 500 volts at 250 mA and also a new mercury-vapour rectifier GU5, which can deliver some 1,250 volts at 0.5 ampere. The U17 is a rectifier which finds particular application in television apparatus, for it has an output of nearly 3,000 volts at 30 mA. A new valve which finds special application in television receivers is the MSP41, for it has a mutual conductance of 3.2 mA/V with 4 volts grid bias, 250 volts anode and 240 volts screen potentials; it is an HF pentode. The N43 is another valve designed for television sets; it is similar to the N41 output pentode, but has much lower inter-electrode capacities.



Osram HA1 Acorn valve for ultra-short-wave work.

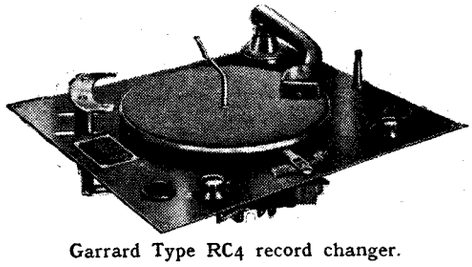
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Olympia Show Report—

GARRARD (37)

The motors and radiogram units manufactured by this firm need no introduction, but visitors to this stand will find an interesting addition to the range in a new and inexpensive record-changer, Type RC4, at £7 10s. The principle of operation is simple and the construction robust, and the mechanism will play eight 10-inch or eight 12-inch records. The unit is compact and should be particularly useful where cabinet space is restricted.

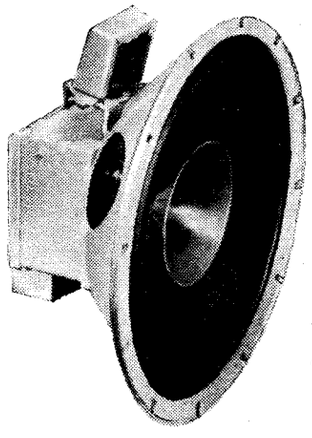
Garrard Engineering & Manufacturing Co., Ltd., Newcastle Street, Swindon, Wilts.



Garrard Type RC4 record changer.

GOODMANS (87)

The high fidelity "Auditorium" loud speakers recently introduced by this firm are the principal source of interest on this stand. Both are fitted with unusually powerful magnets, the flux density in the 12-inch model being of the order of 16,000 lines per sq. centimetre. The price of the 12-inch model is £7 13s., and of the 10-inch unit £3 10s. Both are available in three-foot square oak baffles at 10 guineas and 6 guineas respectively. The "Grille" permanent-magnet



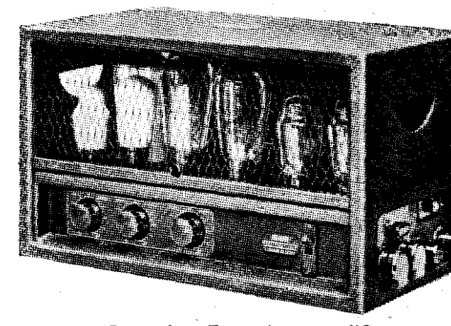
Goodman's 10-inch "Auditorium" speaker.

speaker has been fitted with a larger permanent magnet and a newly developed cone diaphragm, the price remaining at 45s. New 8-inch units of the permanent magnet (type PM8A) and energised type (E8A) have been introduced at 25s. in both cases.

Goodmans Industries, Ltd., Lancelot Road, Wembley, Middlesex.

GRAMPIAN (21)

The new Grampian Type A25 amplifier at £45 is a notable addition to the very wide range of PA equipment shown by this firm. It has an output of 25 watts, and its response curve is flat within 3 db. up to 10,000 cycles. The overall gain is 94 db., and it is therefore suitable for use with the new Grampian velocity microphone at 10 guineas. The PA equipment shown embraces rack-mounted permanent installations as well as complete portable outfits. The domestic moving-coil loud speaker units, of which the "Pantone" at 2 guineas and the "Major" PM model at



Grampian Type A25 amplifier.

5 guineas are leading examples, will be continued throughout the coming season.

Grampian Reproducers, Ltd., Station Avenue, Kew Gardens, Surrey.

H.M.V. (54)

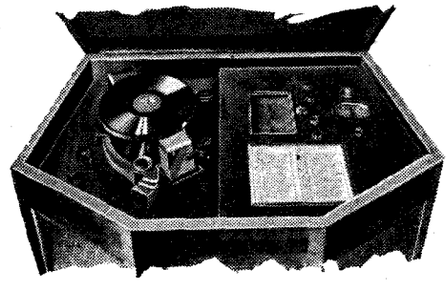
In the space at our disposal it is possible to indicate only the highlights in a programme comprising not far short of a score of receivers and radio-gramophones.

The new ultra-short wavelengths are catered for in many of the sets, so that those who cannot immediately avail themselves of the new H.M.V. television sets will be able to enjoy some part of the new service. The Model 801 radio-gramophone is an example. In addition to the normal broadcast bands it has three waveranges covering 7 to 140 metres. The output stage is the same as that of the Model 800 high fidelity instrument, and three elliptical cone loud speakers are fitted in the bow-fronted cabinet. There is ample record storage space, and the price is 80 guineas.

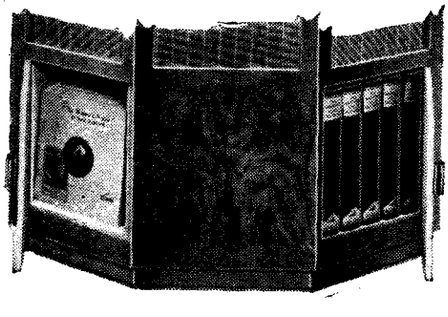
The same chassis with a 3-watt output stage forms the basis of another interesting cabinet design—the Model 581 at 48 guineas, which resembles a writing bureau.

A chassis of entirely new design is incorporated in the Model 149 all-wave battery receiver at 9½ guineas, and the range of H.M.V. accessories includes a new anti-static all-wave aerial equipment with three elements of different length designed to give maximum efficiency at certain points, including the 7-metre waveband.

Gramophone Co., Ltd. (H.M.V.), 98-108, Clerkenwell Road, London, E.C.1.



The control panel, and below the record storage compartment in the H.M.V. All-wave Autoradiogram, Model 801.



HALCYON (73)

The Halcyon all-wave superheterodyne is a three-band receiver tuning from 16.5 to 2,000 metres in which special attention has been paid to the tuning system; the receiver costs 12 guineas. The cam-operated wave-change switches are fitted with solid silver contacts, and it is claimed that their action is unimpaired by prolonged use. The set is for AC/DC supplies.

A cheaper all-wave model is the Halcyon "Briton" with a similar wavelength coverage which costs 10 guineas (AC/DC).

Blue Spot loud speakers and pick-ups are shown on this stand.

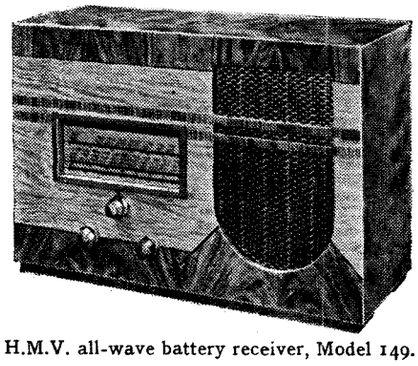
Ismay Distributors, Sterling Works, Dagenham, Essex.

HARMER & SIMMONS (217)

The activities of this firm are devoted entirely to the conversion of sets and power supply units when a change is made in the nature of the electric supply.

A comprehensive range of rectifier units, and also battery eliminators, are shown on this stand at prices ranging from £2 2s. 6d. to £4 2s. 6d.

Harmer & Simmons, Ltd., 223, Hoe Street, Walthamstow, London, E.17.



H.M.V. all-wave battery receiver, Model 149.

HARRIES THERMIONICS (2)

An All-Stage valve forms the principal exhibit on this stand. It is of the indirectly heated type with five grids and an anode and provided with an 8-pin base. When used as a frequency-changer it is rated for a conversion conductance of 0.75 mA/V and a resistance of 1 megohm. Two different operating conditions are specified for the valve when acting as an amplifier; one gives a mutual conductance of 2.2 mA/V with an AC resistance of 1.2 megohms, while the other gives g=1.4 mA/V and a resistance of 0.75 megohm.

The valve can also be connected to act as a triode and it can be used as an output valve of the "critical-distance" anode type, and an output of about 3 watts is claimed.

A particular feature of the valve when operating as an amplifier or frequency-changer is that AVC bias is not applied to the control grid but to a special grid used only for AVC purposes.

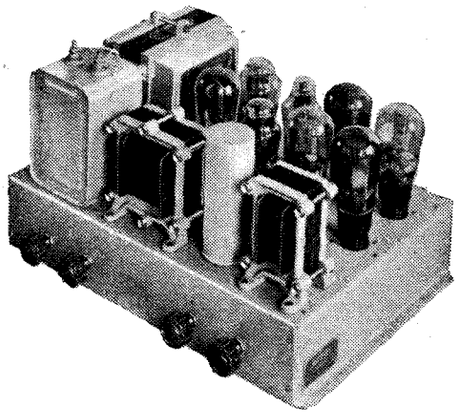
Harries Thermionics, Ltd., Avenue Chambers, Vernon Place, Southampton Row, London, W.C.1.

HAYNES RADIO (13)

A wide range of receivers, amplifiers, and cathode-ray gear is to be found on this stand. Two main types of amplifier are shown with outputs of 6 watts and 14 watts. Push-pull output is used with triode valves and fed by the duophase system from a triode amplifier. Provision is made for the excitation of the field winding of a loud speaker, and the 6-watt model costs £15 10s.

Olympia Show Report—

Receivers for use with these amplifiers are of the straight type, two HF stages being used with iron-cored tuning coils. Amplified AVC is fitted. For short-wave reception, a superheterodyne converter is available.



Haynes Radio double time-base unit for television.

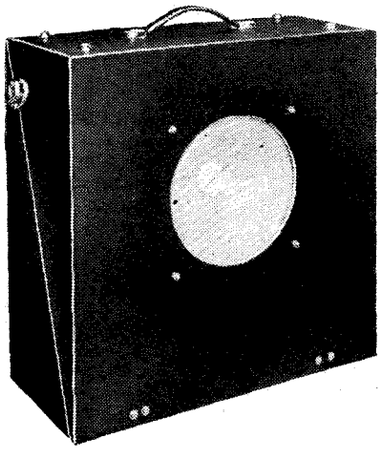
This employs a triode-hexode frequency-changer and covers the unusually wide range of 6-90 metres. The unit derives its power from the normal mains equipment of the receiver.

Among the cathode-ray gear, a double time-base unit, suitable for television work, is of particular interest. Gas-filled relays are employed in the generation of the saw-tooth waveform, and the output for the deflecting plates is taken in push-pull, up to 1,000 volts being available. Provision is also made for synchronising and shift. The unit is priced at £23, and a high voltage unit for supplying the CR tube at £9 10s.

Haynes Radio, Queensway, Enfield, Middlesex.

HEAYBERD (25)

Occupying a prominent position on the stand, the Portable Amplifier is worth inspection by all interested in PA equipment. The whole apparatus, including amplifier, speaker, and microphone, packs into a case measuring only 19in. × 19in. × 8½in., and can be operated from AC or DC mains. The amplifier has two stages, the output valve being a pentode, and the complete equipment is priced at 15 guineas.



Heayberd Portable amplifier.

A battery charger capable of charging a 12-volt accumulator at 5 amperes is shown at 90s., as well as other models with smaller output ratings. HT supply units are also to be seen, as well as a wide range of mains transformers and smoothing chokes.

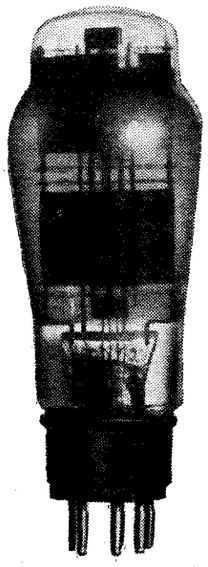
F. C. Heayberd & Co., 10, Finsbury Street, London, E.C.2.

HIVAC (26)

The Harries tetrode output valves form one of the main features of this exhibit. They are available in 2-volt battery types and in 4- and 13-volt indirectly heated models. The AC/YY, which consumes 2 amperes at 4 volts, is rated for 300- and 250-volts anode and screen potentials; the output from a pair in push-pull is rated at 11 watts.

Short-wave valves with "top-grids" and ceramic bases are also on view, and the range of midget valves is extended by a triode encased in a metal sheath. In addition, there is a range of 13-volt valves for car and AC/DC sets.

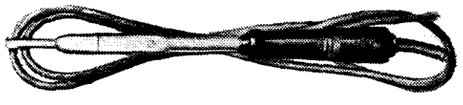
High Vacuum Valve Co., Ltd., 113, Farringdon Road, London, E.C.1.



Hivac AC/YY output valve.

HENLEY'S (28)

The usefulness of the well-known Solon soldering iron has been increased, so far as radio work is concerned, by the introduction of a new model fitted with a pencil-shaped bit held in position by a non-



Solon soldering iron with new pencil bit.

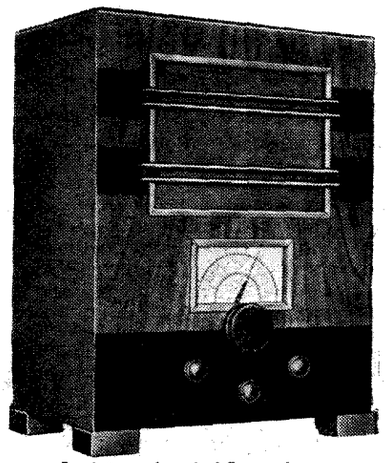
corroding stainless steel grub screw, and so easily removable for replacement. These soldering irons are so designed that there is a minimum of wastage of energy, the heat generated being dissipated directly into the bit.

A useful accompaniment of the soldering iron is Solon resin-cored solder, which is produced in tubular form with a resin filling which provides the right amount of non-corrosive flux. Henley's slide-back wire, specially manufactured for the internal wiring of radio sets, is also shown; the conductor is exposed for soldering merely by pressing back the insulating covering.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.

INVICTA (35)

So far as many of the new receivers are concerned, "all-wave" is largely a courtesy title. The Invicta AW57 superhet certainly has a much better right to the title than the majority; it embraces all wavelengths between 13 and 2,000 with the exception of a small gap between 550 and 800 metres—a band in which nothing but Morse transmissions are to be found, and which is accordingly of no interest to the broadcast listener. The third band (75-200 metres) is one that is usually omitted, but which contains the trawler and yacht wavelengths. This is an AC receiver.



Invicta 3-band AC receiver.

Another set, this time for battery operation, which has an unusual wave-range coverage is the "Fisherman" model, which, in addition to both broadcast wavebands, covers the 90-220 metre band.

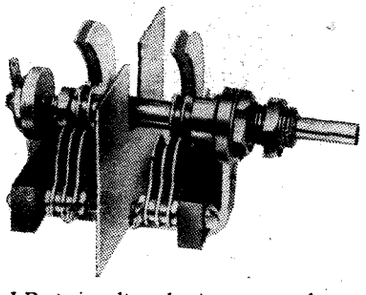
More conventional receivers include a three-band straight model for either battery or AC mains, and also broadcast-band sets of the two-circuit and three-circuit types.

Invicta Radio, Ltd., Radio Works, 79a, Parkhurst Road, London, N.7.

J.B. (81)

Few changes have been made to the J.B. condensers this year, and all last season's models are retained in sensibly the same form. Being of advanced design they fully meet all present-day requirements.

Of special interest are the short and ultra-short wave components. There is a well-designed twin-condenser in 15, 30 and 45 mmfd. sizes costing 5s. each, a single model of the same pattern in 15 and 30 mmfds. at 3s. 9d., and some air-dielectric pre-set condensers of 50, 75 and 100 mmfds. at 2s. 6d. each.



J.B. twin ultra-short-wave condenser.

Complete tuner units and slow-motion condenser drives in a variety of styles are also shown.

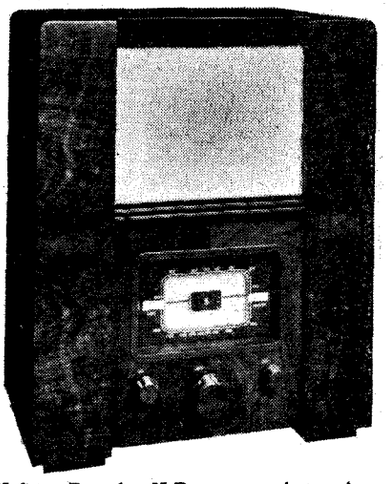
Jackson Bros. (London), Ltd., 72, St. Thomas's Street, London, S.E.1.

K-B (57)

Among the receivers shown by this firm must be mentioned the K.B.540. It is designed for AC operation, and covers the medium and long wavebands. A heptode frequency-changer is used with one IF valve, a duo-diode for detection and AVC, and an output pentode. Variable selectivity is included, and operates by a variable coupling between the coils of one of the IF transformers. The set is listed at 11½ guineas.

Olympia Show Report—

An all-wave receiver, the K.B.560, covers 19-52 metres, in addition to the broadcast bands. The frequency-changer is a triode-hexode, and the IF amplifier, which operates at 460 kc/s, employs iron-cored coils. A dual-ratio tuning dial is fitted, and the price is 16 guineas. The K.B.515 is a smaller all-wave set with the same tuning range.



Kolster-Brandes K.B.540 superheterodyne.

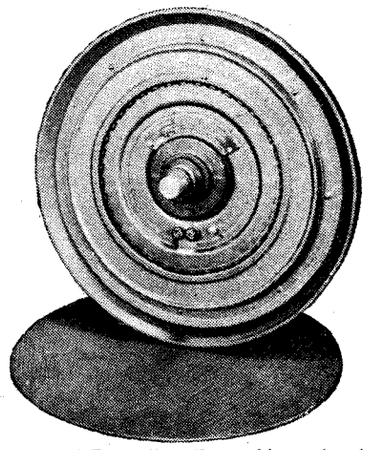
It is a straight set with one HF stage, a triode detector, and a pentode output valve; it costs 9½ guineas. A similar receiver covering only the medium and long wavebands is the K.B.510, priced at 8½ guineas. An AC/DC model is available at the same price, and a battery model at 7½ guineas; the anode current consumption of this set is about 8 mA. A battery superheterodyne is also on view.

All these receivers are arranged for use with the Rejectostat aerial system, which can be used with any receiver. The Rejectostat outfit costs 25s., and includes the necessary transformers.

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

KINGSWAY ELECTRICALS (88)

The Simpson's Recording Turntable is the principal exhibit on this stand. The turntable is intended for home-recording, and consequently has a much more powerful drive than the tables for reproducing only.



Simpson's Recording Turntable and rubber disc grip.

It is priced at 5 guineas. The ordinary Simpson's turntables are also shown, and cost 2 guineas.

Kingsway Electricals, Ltd., 3-9, Dane Street, London, W.C.1.

LINGUAPHONE (106)

The recording radio-gramophone is an obvious development, but apparently the Linguaphone Recordiogram is the only instrument shown which combines the necessary apparatus for home recording with a radio-gramophone as a single unit. This instrument is available in various forms; the "All World" model embodies an eight-valve superheterodyne chassis, and employs two PX4's in push-pull, which feed into a Magnavox Duode speaker. Wavelengths between 13 and 2,000 metres are covered, and records can be made either from received wireless signals or through a microphone. A recording gramophone is also shown, and there is a particularly compact table Recordiogram which combines the various functions of the larger instrument (excepting short-wave reception).

Linguaphone, Ltd., 24-27, High Holborn, London, W.C.1.

LISSEN (64)

One of the most interesting of the Lissen receivers is a four-band AC mains superhet covering short waves between 13 and 82 metres in two steps. Variable selectivity is provided, together with several other refinements. Another all-wave set—a straight model—has a single short-wave band (18-54 metres), and is available both for battery and universal mains supplies.

For home constructors there is a "band-spread" three-valve short-wave receiver for which the components complete with valves cost only 69s. 6d.

Lissen Picnic Portable.

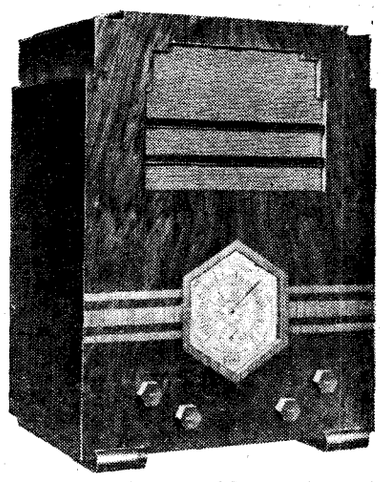
In addition to these more specialised receivers there is a series of sets for the normal broadcast bands. An AC superheterodyne with an unusual circuit arrangement is shown; amplification of IF signals is carried out, not by the usual valve stage, but by fixed reaction between anode and grid circuits of the second detector, which is a triode feeding directly into an output pentode.

The Lissen Picnic Portable is of the latest type in which the speaker is mounted on an inclined baffle which is automatically raised into position when the lid is opened. The circuit is the conventional arrangement of HF-det.-2LF with an output pentode.

Lissen, Ltd., Worple Road, Isleworth, Middlesex.

McMICHAEL (47)

Among the new mains receivers introduced by McMichael this year is an all-wave five-valve (including rectifier) superheterodyne in which particular attention has been given to the short-wave performance. Its wave-ranges are 18.6 to 51, 200 to 500, and 900 to 2,000 metres respectively, and the dual ratios of 20 to 1 and 3 to 1 are embodied in the tuning control, together with a vernier scale and a separate pointer. These will be found very useful on the short waves. Known as the Model 362, it costs 15½ guineas, is for AC mains operation, and is rated to give two watts output. Provision is made for the use of a gramophone pick-up as well as for an extension loud speaker.



McMichael all-wave AC superheterodyne, Model 362.

The Model 366 is also new and of special interest in view of the unique style of tuning dial embodied. This is an AC radio-gramophone having a five-valve (including rectifier) circuit of modern design. The McMichael Giant tuning dial, some 22in. in diameter, is mounted in a recess in the underside of the lid which, when open, brings the scales conveniently level with the eye. The pointer is remotely operated from a tuning control on the motor board. In a very attractively finished cabinet it costs 24 guineas.

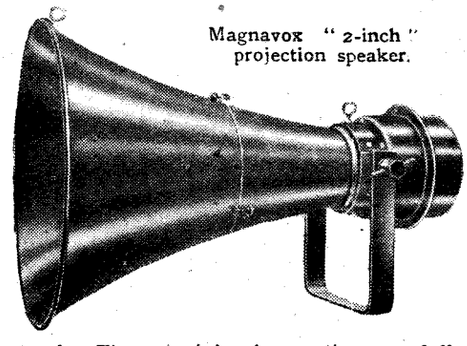
Among the new battery models is a five-valve transportable superheterodyne receiver which is entirely self-contained, having a built-in aerial, and though obviously a long-range set is quite economical, for the average HT consumption is only about 10 mA. It includes a permanent magnet moving coil loud speaker, with provision for an additional external one and for gramophone reproduction, the price being 14 guineas.

A lightweight suitcase portable of quite recent introduction is also shown. Special attention is being given this year to well-made and handsomely finished cabinets, all the new McMichael sets being very attractive indeed.

McMichael Radio, Ltd., Wexham Road, Slough, Bucks.

MAGNAVOX (91)

The Magnavox "Duode" Model 33 with double voice-coil construction may be regarded as the principal exhibit on this



Magnavox "2-inch" projection speaker.

stand. The principle of operation was fully described in our issue of March 6th, 1936, and there can be no doubt that this speaker has made a valuable contribution to the science of high-quality reproduction. For

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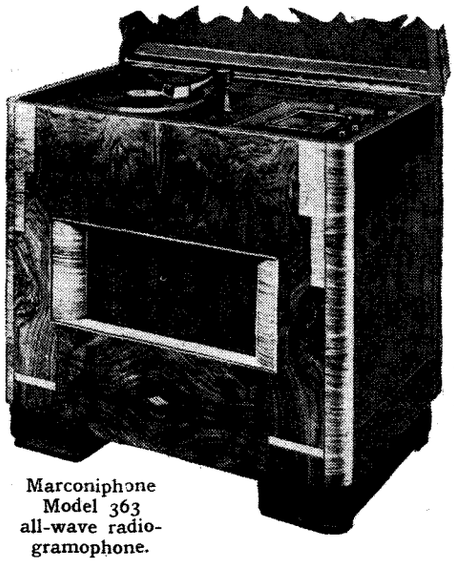
light PA work where a higher power-handling capacity is required the Magnavox Model 66 is being continued and the "Two-inch" projection model, specially designed for continuous operation at 25-30 watts, will also be shown. Manufacturers' requirements are also catered for by a full range of loud-speaker chassis.

The extended frequency range of the "Duode" speaker has necessitated the introduction of a special whistle filter for the elimination of heterodyne interference, and this component has been added to the list of Benjamin radio components such as the "Transfeeda" LF coupling unit and Class B input and output transformers, anti-microphonic valve holders, etc. The whistle filter, which is fitted with a frequency adjusting screw, is available for both 2-ohm and 15-ohm voice coils, the prices being 15s. and 12s. 6d. respectively.

Benjamin Electric, Ltd., Brantwood Works, Tariff Road, London, N.17.

MARCONIPHONE (49)

Of the two television receivers shown on this stand one incorporates a complete all-wave receiver and the other is for vision only. The latter instrument is designed to



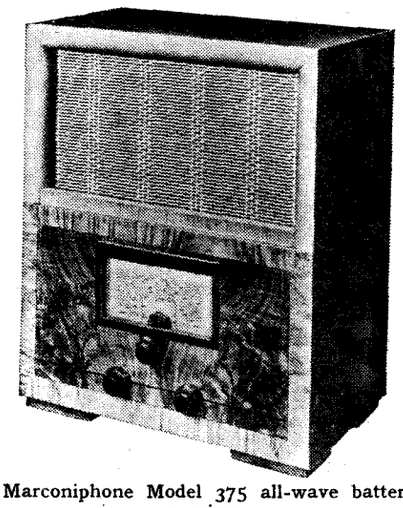
Marconiphone Model 363 all-wave radio-gramophone.

be complementary to the new all-wave receivers which now incorporate three short-wave bands, including a 7-16-metre range covering the television sound transmissions. The table model in this group is the Model 346 at 18½ guineas, and there are two radio-gramophones, Models 363 and 366, at 28 and 36 guineas respectively, the latter with automatic record-changer.

A cathode-ray tuning indicator, termed by Marconiphone the "Thaumoscope," is incorporated in the Model 534 all-wave receiver at 16 guineas. This 6-valve instrument, like the simpler 5-valve AC super Model 556 at 13½ guineas, includes a single short wave-range from 16 to 50 metres. There is also a 4-valve AC/DC version—the Model 382 at 13½ guineas. Battery users are provided with an all-wave receiver in the new Model 375, a "straight" three-valve set at 9½ guineas. The short-wave range in this instrument is from 18 to 50 metres.

The above by no means exhausts the Marconiphone programme, and there is a wide choice of receivers and radio-gramophones for the medium- and long-wave bands as well as a car radio receiver. The circular and elliptical cone speakers used in the sets are available as extension units, and other accessories include a static-free all-wave aerial assembly—and, of course, the full range of Marconi valves.

Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1.



Marconiphone Model 375 all-wave battery receiver.

MILNES (205)

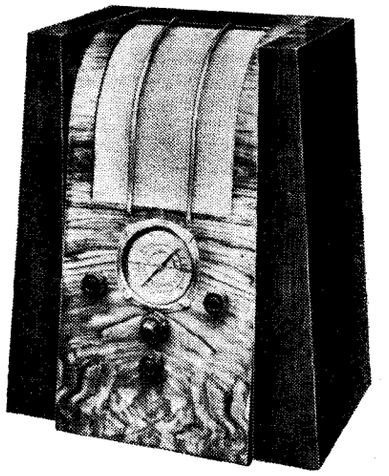
The main feature on this stand is the range of Milnes HT units in which nickel-cadmium cells are used and provision is made to join them in banks of low voltage for charging from a 6-volt LT accumulator. Three sizes are shown for discharge at 15, 30, and 60 mA maximum respectively.

There is also a range of receivers, most of which include a superheterodyne chassis. Two are for AC mains and two for battery operation, the latter having a special compartment in the cabinet for the Milnes unit.

A special feature of these sets is that all include an ultra-short-wave range, in addition to short-, medium-, and long-wave ranges.

Very attractive cabinets are used, and prices range from £4 19s. 6d. to £17 17s.

Milnes Radio Co., Ltd., Church Street, Bingley, Yorks.



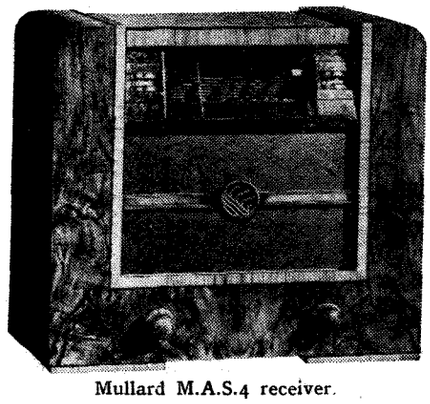
Attractive cabinet design adopted for Milnes all-wave receivers.

MULLARD (62)

The M.A.S.5 is one of the most interesting receivers on this stand, for feed-back is used in the LF amplifier to improve the quality of reproduction, and it does this by reducing amplitude distortion. The tuning control is also of an ingenious type, a single knob with an encircling collar performing the functions of tuning, volume and tone controls, and waveband switching. The receiver is a superheterodyne with an intermediate frequency of 128 kc/s and having an octode frequency-changer. It covers 16.7-51 metres in addition to the normal broadcast bands, and costs 17 guineas.

The M.A.S.4 is also an all-wave set, and the IF amplifier includes variable-selectivity. The output valve is a pentode delivering 3.5 watts to the loud speaker. It is priced at 14 guineas. A smaller set with the same tuning range is the M.A.S.3 at 11½ guineas; this has a stage less of amplification, but in other respects is very similar. The M.B.3B. is a battery set covering the medium and long wavebands. Three valves are used and arranged as HF amplifier, pentode detector, and pentode output.

A wide range of valves is shown, among which the Acorns are especially interesting. Designed for use at ultra-high frequencies, a triode and a screened pentode are available. A special HF pentode for television receivers is also to be found; this is the T.S.P.4 with a mutual conductance of 4.73 mA/V. There is also a cathode-ray tuning indicator, the TV4—a miniature cathode-ray tube combined with a triode amplifier.



Mullard M.A.S.4 receiver.

Television cathode-ray tubes are also shown, the largest being the 42-12 with a screen diameter of 30 cms. The screen is white and the tube requires a maximum operating potential of 5,000 volts. A wide range of smaller tubes for television and oscillographic purposes is to be found.

Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2.

MULTITONE (86)

Extreme compactness and lightness is probably more desirable in a deaf-aid than in any other piece of apparatus in which wireless technique is used. In order to reduce the weight and bulk of the Multitone miniature amplifiers, negative reaction is employed for tone and volume control. Various models employing this principle are shown.

An important feature of most of the apparatus is described as an Automatic Volume Check. As all users of ordinary microphones and amplifiers know, there is a tendency for loud noises to be amplified to an uncomfortable extent, while feeble sounds may remain too weak. The purpose of the Multitone limiting device is to save the deaf listener from nerve-racking crashes and other over-amplified sounds and, at the same time, to provide him with the amplification that he needs.

The principle of "unmasked hearing" by means of separate high-note and low-note headphones is available with the sound-magnifying apparatus and also with the Adaphone, a unit for connection to a normal

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broadcast set which enables a deaf listener to hear through headphones without disturbing normal reproduction through the loud speaker.

The well-known Multitone tone correction transformers are also shown.

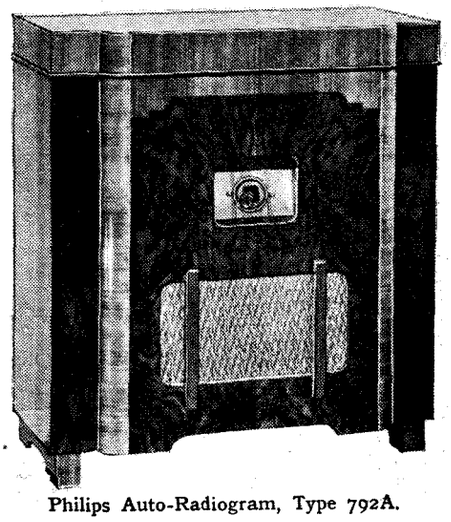
Multitone Electric, Ltd., 95, White Lion Street, Islington, London, N.1.

PERTRIX (71)

This firm is showing a wide range of dry batteries and LT accumulators, the dry batteries being divided into two categories described respectively as salammoniac and non-salammoniac types. Some new models are now available in the Bulldog series, and there is also a range of miniature HT batteries made especially for use in small portable sets and deaf-aid amplifiers.

A special feature is made of replacement batteries, the voltage and dimensions of which are arranged to suit practically every battery-operated proprietary receiver on the market.

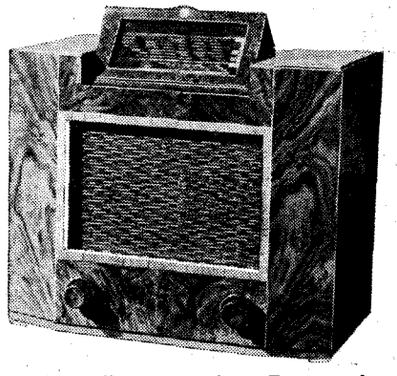
Britannia Batteries, Ltd., Union Street, Redditch, Worcs.



Philips Auto-Radiogram, Type 792A.

PHILIPS (43)

This year's programme shows that the research and development departments of Philips have been more than usually active. "Mono-Knob" control, giving simultaneous adjustment of tuning, volume, tone and selectivity, is incorporated in all the more important sets, while another useful aid to tuning is the "Electron Star" cathode-ray tuning indicator. The "Adaptovisor" dials, which may be tilted to any convenient angle according to whether one is standing or sitting in front of the cabinet, solve a cabinet designer's problem of long standing.



Philips all-wave receiver, Type 745A.

Fine tuning is also greatly facilitated by the automatic two-speed tuning device, which changes from fast to slow motion immediately the direction of rotation is reversed.

The problem of the 100-volt DC supply has been solved in all the sets designed for DC mains by the inclusion of a vibratory converter, which now puts these receivers on the same footing as regards HT volts as those working from AC mains.

The range of sixteen sets starts with a simple battery set (Type 821B) at 7 guineas, and a universal AC/DC equivalent (Type 213U) at 9½ guineas. All the remaining instruments incorporate a short-wave band from 16.7 to 51 metres, and the most elaborate specification is that of the Type 792U radio-gramophone at 40 guineas.

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

PIX (209)

Small but important accessories, mainly in connection with the aerial and earth systems, are shown on this stand. Indoor aerials, lightning arrestors, and the Pix selectivity device, together with a chemical "earth," constitute some of the items, and, in addition, there is a range of battery and mains valves.

British Pix Co., Ltd., 118, Southwark Street, London, S.E.1.

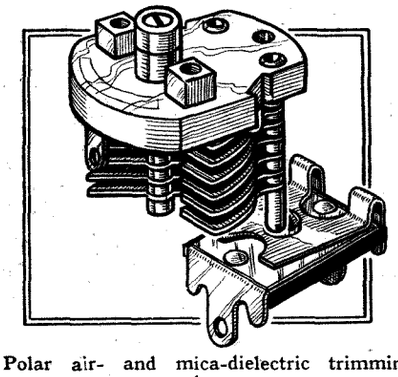
PLESSEY (27)

The apparatus shown by this firm is available to set makers only and includes new variable condensers having minimum capacities of the order of 10 mmfds. only for use in all-wave receivers. The older gang condensers are also shown, as well as a number of condenser drives and components, such as valveholders, waverange switches, etc.

Plessey Co., Ltd., Vicarage Lane, Ilford, Essex.

POLAR (97)

A new form of construction is being adopted by Wingrove and Rogers this year for their gang condensers. The new style, which is known as the Bar-type, employs



Polar air- and mica-dielectric trimming condensers.

a sturdy steel frame, is fitted with aluminium vanes, and has the rotor supported in ball bearings. Bakelite insulation is used in the standard models, but ceramic insulation is available as an alternative. A three-gang assembly costs 17s. 6d. with bakelite, and 20s. with ceramic insulation.

The single unit in this series is known as the Polar No. 5 condenser, and is made in sizes from 0.0001 to 0.0005 mfd., also with the alternative style of insulation.

The Midget gang condensers are retained this year, so is the Compax solid dielectric type, as well as the range of full-vision dials.

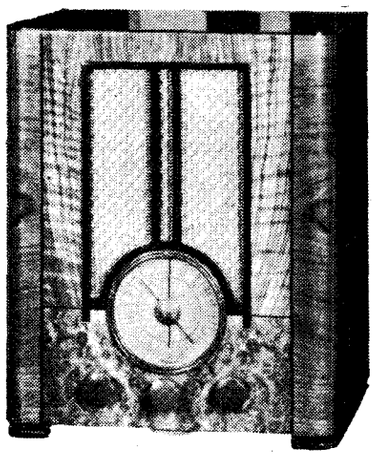
A small air-dielectric trimming condenser with a steatite base is shown in capacities of 25, 50, 75, and 100 mmfds., and costs 3s., and there is also a new miniature mica-dielectric trimmer, which costs 1s. for a 3 to 30 mmfds. size, and 1s. 3d. for one of 40 to 80 mmfds.

In addition, there is to be seen on this stand the full range of Polar-N.S.F. components, which comprise semi-dry electrolytics, fixed tubular condensers, resistances, and volume controls, the latter being described as chemical track type, and they are shown with and without built-in mains switches.

Wingrove & Rogers, Ltd., Arundel Chambers, 188-189, Strand, London, W.C.2.

PORTADYNE (46)

An attractive cabinet design with a "clock-face" tuning dial has been adopted for the four superheterodyne receivers which



Portadyne Model A53.

are included in the range of sets manufactured by this firm. The Model A52 at £10 19s. 6d. has a four-valve circuit consisting of a frequency-changer, IF amplifier, double-diode-triode detector, and pentode output valve. It covers the medium- and long-wave bands, and the "Porta" self-contained aerial is included. The Model A53 has the same basic circuit, with the addition of a 16-50 metre short-wave range. The price is 12 guineas. Model 64 at 14 guineas has an all-wave circuit similar to that of the Model A53, but with the addition of an HF amplifying stage. Model B42 is a battery superheterodyne at 9 guineas, and is interesting for the fact that the output pentode has associated with it a Westector battery economy circuit. Two "straight" circuit battery receivers complete the range, namely, the Model B32 table model at £6 15s. and the Model PB42 portable at 9 guineas.

Gorst Electrical Co., Ltd., Portadyne Works, Gorst Road, London, N.W.10.

PRIMUS (1A)

This firm is now concentrating on dry batteries of all types, including HT batteries of various capacities under the titles of "Primus Standard," "Fulovolt," and "Vap." The 120-volt "Primus Standard" battery at 6s. is a representative example. The range also includes the "Autocel" dry batteries for high tension and lighting which are specially suitable for export.

Primus Manufacturing Co., 64, High Street, Battersea, London, S.W.11.

PRIMOGRAPHIC (223)

This firm is showing examples of a new process of photo-chemical reproduction on

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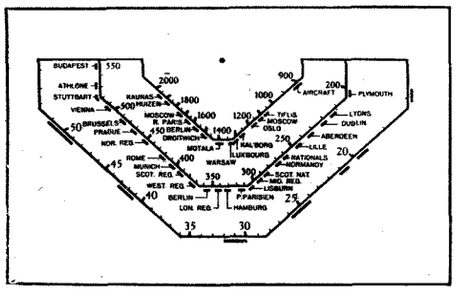
glass, celluloid, metal, wood, etc. Reproduction in colours can be made, and the



Tuning scale on glass prepared by the Primographic process.

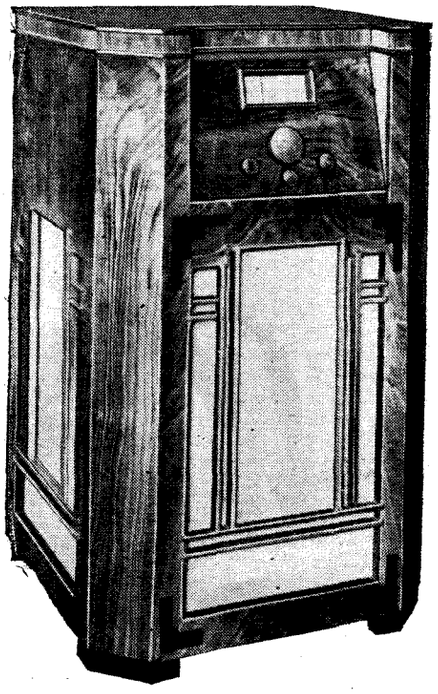
specimens of the tuning scales exhibited are very attractive indeed.

Primographic Co., Ltd., 40-44, Clipstone Street, London, W.1.

PRISM (80)

The Type PR47 radio-gramophone is an unusually interesting instrument on account of the acoustic design of the cabinet, which incorporates a labyrinth of graded sounding boards. This instrument is available with either a "straight" or a superheterodyne circuit, the price in both cases being 45 guineas.

Additions to the PA equipment manufactured by this firm include the RG47 portable playing desk, radio receiver and microphone at 25 guineas, which is designed for hire work, and a new amplifier, Type



Prism radio-gramophone, Type PR47.

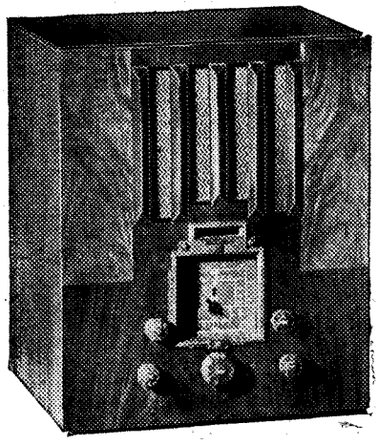
AC81, suitable for use with insensitive microphones. The overall gain is 110 db., and the output is rated at 45 watts with a maximum limit of 64 watts.

Prism Manufacturing Co., California Works, Brighton Road, Belmont, Surrey.

PYE (48)

Although it is not the most ambitious model, the Pye T10 is representative of the present season's receivers. It is a four-band set covering wavelengths between 13 and 2,000 metres, and in the design special pains seem to have been taken to make short-wave listening practical for the unskilled user. The tuning system is carefully planned, the dial being divided into four segments, one for each channel. There are separate coupled pointers which indicate the tuning positions both by station name and wavelength on all bands. A secondary control for use on short waves provides a reduction gear of 200:1. Variable selectivity and tone control are fitted, and there is a neon tuning indicator.

The recently introduced Empire receiver, which is mounted in a console cabinet, has a rather more ambitious specification, but covers the same bands of wavelengths. It is understood that this receiver has stood up extremely well to the exacting conditions of use overseas. Another Pye all-wave set is the model T10A, which costs 16 guineas.



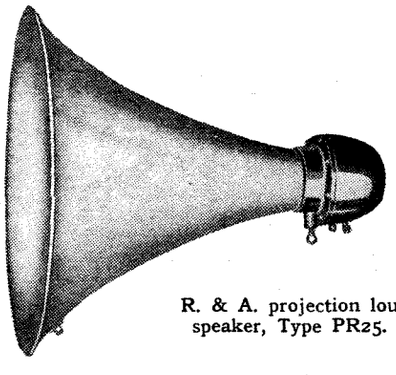
Pye all-wave receiver, Model T10A.

Among the Pye "broadcast band" receivers, the T18 superhet is interesting, as it embodies a combined selectivity and tone control, and there is a two-position variable sensitivity switch.

For the listener who cannot erect an aerial there are two self-contained models with similar specifications for either battery or AC mains; these are the models T61 and T20 at 15 guineas and 16 guineas respectively. There is also a straight AC portable (Model T/M at 11 guineas). The DC user is catered for with a universal straight set.

Special provision for accessibility is made in the Pye receivers, and in many cases parts are get-at-able without moving the chassis from the cabinet.

Pye Radio, Ltd., Africa House, Kingsway, London, W.C.2.

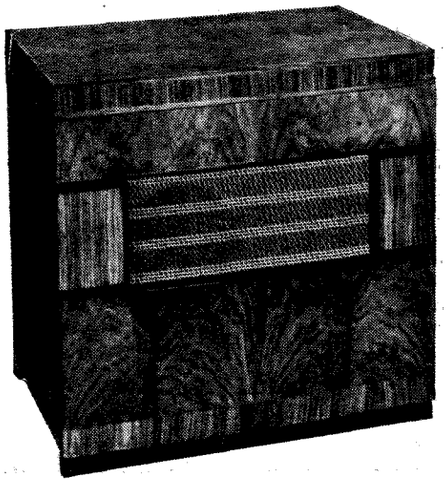


R. & A. projection loud speaker, Type PR25.

R. & A. (92)

Reproducers for PA work form an important section of this firm's activity. Among these are included the new Models PR25 and PR35 of the projection type, with permanent-magnet units and exponential horns. There is also a new cone type PA unit known as the PR1003. It has a 10½-inch diaphragm and is listed at 50s.

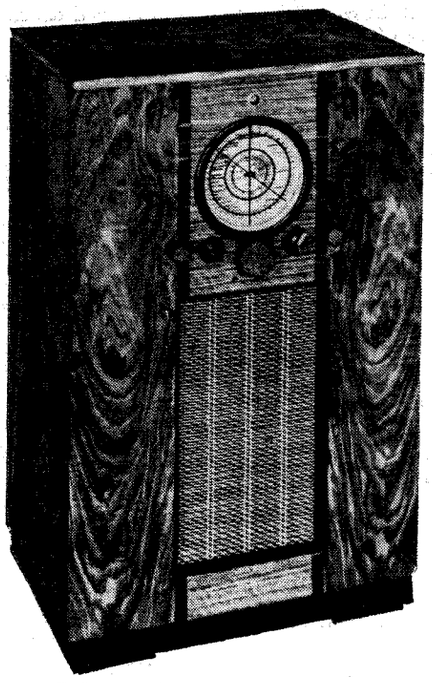
Reproducers & Amplifiers, Ltd., Frederick Street, Wolverhampton.



R.G.D. radio-gramophone, Model 645.

R.G.D. (56)

All-wave tuning is no novelty in R.G.D. instruments; the makers were among the first to provide for short-wave reception in sets designed for high-quality broadcast reproduction, and for the present season



R.G.D. radio console, Model 630.

all models cover wavelengths between 16.5 and 2,000 metres in four steps.

The same chassis is fitted in the Model 625 table set (25 gns.), the 630 console (30 gns.), and 645 automatic radio-gramophone (45 gns.). A signal-frequency HF stage is operative on all bands, and a two-position selectivity control switch functions by throwing into circuit an extra coupling winding in the first IF transformer in the high-fidelity position. A

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tone control gives three stages of high-note attenuation, and in the fourth position reduces bass response. An output of 3 watts is obtained from a triode valve.

Model 660 radio-gramophone has a somewhat similar specification, but gives 3½ watts and has a four-position variable selectivity switch which controls IF transformer coupling. There is a cathode-ray tuning indicator fed from the bias voltage of the second detector; this is found to give a better indication than the usual method of deriving operating voltage from the AVC system.

A more ambitious LF amplifier with push-pull output is used in the Model 880, while Model 1220, the highest-priced instrument (120 gns.) has a number of extra refinements, including a second IF stage and a separate valve for amplifying AVC voltage at intermediate frequency before rectification. Selectivity is controlled by mechanical variation of coupling in two IF transformers. A push-pull output stage giving 9 watts feeds a single speaker, which is completely enclosed in a chamber which prevents radiation from the back of the cone.

Radio Gramophone Development Co., Ltd., 18-20, Frederick Street, Birmingham.

R.I. (30)

The activities of this firm are largely devoted to the design and production of specialised receivers, such as those for schools, hospitals, etc. The R.I. schools sets are fitted into plain but very serviceable teak cabinets, and are designed for use with external loud speakers usually mounted on a large 30in. baffle board.

A three-valve circuit is employed consisting of an HF stage, a triode detector, and pentode output, using the RI Micrion iron-cored coils throughout. Provision is made for gramophone reproduction, and a typical model for AC mains operation costs £15, including a moving coil speaker. Models for DC mains are also available.

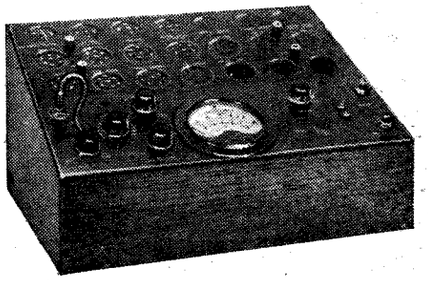
In addition, this firm is showing the Anti-nodal series of short-wave converters and a comprehensive range of components.

Aeronautical and General Instruments, Ltd., Purley Way, Croydon, Surrey.

R.S.G.B. (214)

This stand is the natural rendezvous of all amateur experimenters visiting Olympia. Some fine examples of amateur-built transmitters are shown, one especially interesting model being a crystal-controlled 56 Mc/s transmitter using a 7 Mc/s crystal and several frequency doubling stages. There are also available for examination a 100-watt set and a simple two-valve model, as well as sundry pieces of amateur station equipment.

Radio Society of Great Britain, 53, Victoria Street, London, S.W.1.



Radiolab Service Valve Tester.

RADIOLAB (213)

The Service Valve Tester is the latest addition to the Radiolab series of test apparatus. It is AC-operated and provides filament voltages from 2 to 50, grid bias up to 25 volts and anode voltages of either 100 or 200. A 3¼in. moving-coil meter is included which normally reads the total emission of the valve, but provision is made to use it for mutual-conductance measurements by backing off the steady anode current to zero on the meter and noting the change in current with a one-volt variation in the grid bias. The price is £10 10s.

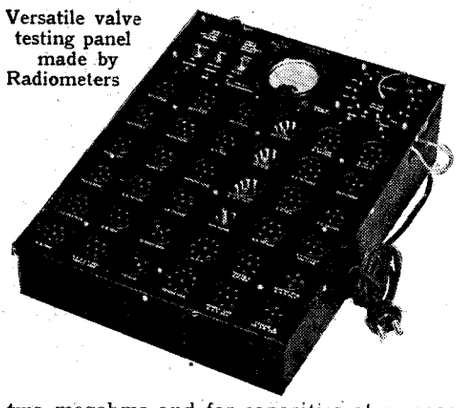
Some minor alterations have been made to the All-Purpose Tester, which now can be used for measuring capacities of from 0.0005 mfd. to 14 mfds. The Universal Oscillator is shown in existing form and also with the addition of a short-wave range covering 25 to 50 metres. With this extra facility it costs 35s. more than the standard model, the price of which is £6 10s.

Everett, Edgcumbe & Co., Ltd., Colindale Works, Hendon, London, N.W.9.

RADIOMETERS (203)

The speciality of this firm is testing equipment, and they are showing a resistance and capacity bridge fitted with a visual indicator, directly calibrated scales for resistance measurement from 100 ohms to

Versatile valve testing panel made by Radiometers



two megohms and for capacities of 0.00002 mfd. to 25 mfds. It is a battery-operated test set and costs £6 6s. Shown, also, is the Versatile All-Valve Tester and a range of AC and DC multi-range meters.

Radiometers, Ltd., Dunbar Works, Dunbar Street, West Norwood, London, S.E.27.

RAWLPLUG (79)

So far as broadcast reception is concerned the principal application of the well-known Rawlplugs is in the erection of aerials, and now that more attention is being paid to those of the anti-interference and "wave" type, etc., the possibility of obtaining secure anchorages by the use of these handy devices should not be forgotten.

Rawlplug Plastic Wood is another product that has many applications.

Rawlplug Co., Ltd., Rawlplug House, Cromwell Road, London, S.W.7.

RIST (208)

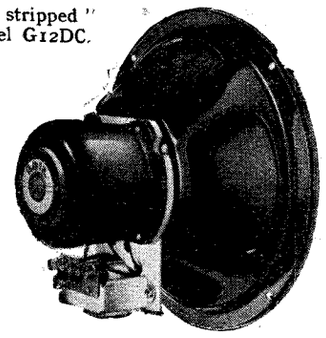
Wires, flexible cables, and multi conductors of every conceivable type required for radio purposes are included on this stand, and if there is any requirement either of the amateur or the manufacturer which has not already been catered for, a glance at the variety of problems which have already been solved by this firm should give confidence that they will be able to tackle any new wiring problems which may arise.

Rist's Wires & Cables, Ltd., Freemantle Road, Lowestoft, Suffolk.

ROLA (93)

The Model G12 high-fidelity reproducer is now available in permanent magnet as well as energised form. Both these types, which, incidentally, are fitted with 12-inch

Rola "stripped" model G12DC.



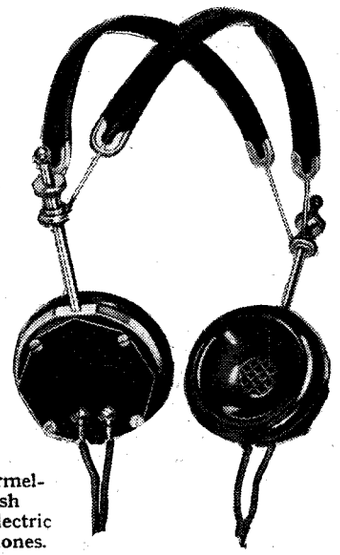
diaphragms, are priced at £5 5s. A stripped model for incorporation in manufacturers' sets is also shown.

The new "Roma" speaker is designed to fulfil all normal extension loud speaker requirements, and is fitted with a transformer with five terminals arranged to give the necessary matching impedances. The 8-inch cone movement is housed in an attractive walnut cabinet, and the price complete is 29s. 6d. Incidentally, the chassis is available separately at 23s. 6d., and with a single ratio output transformer at 21s. There is also a very comprehensive range of both permanent magnet and energised units designed to fulfil manufacturers' requirements.

British Rola Co., Ltd., Minerva Road, Park Royal, London, N.W.10.

ROTHERMEL (89)

The piezo-electric principle has now found application in headphones as well as loud speakers and pick-ups. The Rothermel-Brush phones shown on this stand are listed at 40s. and there is a new Junior pick-up at 32s., the older Standard and De Luxe models being also shown. A piezo-electric microphone is on view as well as a number



Rothermel-Brush piezo-electric headphones.

of tweeters, and the British Centralab volume controls.

A public address unit of the portable type including two moving-coil loud speakers is worth examination. The output is 4½ watts and the apparatus is designed for use with a piezo-electric microphone.

Olympia Show Report—

The Radio-Heart tuning unit is to be seen. It comprises a complete tuner, including gang condenser, coils, waveband switches and valve holders, assembled and wired—the whole of a receiver, in fact, preceding the IF amplifier. A range of some 16.5-50 metres is obtained in addition to the medium and long wavebands, and the circuit is that of a HF amplifier and a heptode frequency-changer, two signal-frequency tuned circuits being used.

R. A. Rothermel, Ltd., Rothermel House, Canterbury Road, London, N.W.6.

SELF CHANGING GRAMOPHONES (59)

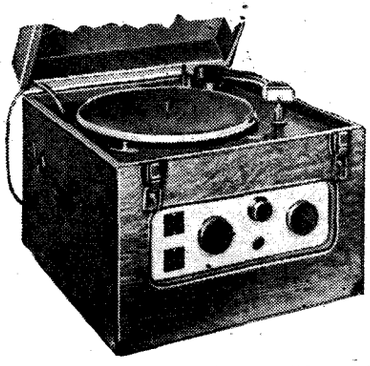
The nucleus of the radio-gramophones made by this firm is an automatic record-changer capable of playing both sides of 10-inch or 12-inch records indiscriminately mixed up to a maximum number of thirty-three. The radio receiver is a super-heterodyne with a signal frequency amplifier and two IF stages, and there are four wave-ranges covering wavelengths down to 13 metres. The instruments are housed in high-grade cabinets of modern and period design, and the prices range from 150-165 guineas. There is also an unconventional portable radio-gramophone mounted in a leather case with a simpler type of record-changer at 28 guineas.

Self Changing Gramophones, Ltd., 11, Berkeley Square, London, W.1.

SHAFTESBURY MICROPHONES (99)

The main interest on this stand is public-address equipment. The MM/15 amplifier can be operated either from AC or DC mains or from a 12-volt car battery and is intended to be used with their new Bio-Tran carbon microphone. It is rated to give 15 watts output, and the price is £36 10s.

In addition to some portable equipment and a series of carbon microphones, they are



Shaftesbury Type M.M/15 amplifier unit.

showing also a velocity ribbon microphone costing 9 guineas.

Shaftesbury Microphones, Ltd., 24, Aldersgate Street, London, E.C.1.

SIEMENS (60)

Siemens dry-cell HT batteries are made in the usual single, double and triple capacities; in addition there is a series of "extra-large capacity," batteries, suitable for discharges between 15 and 30 mA, which are particularly useful for experimental work and other special applications.

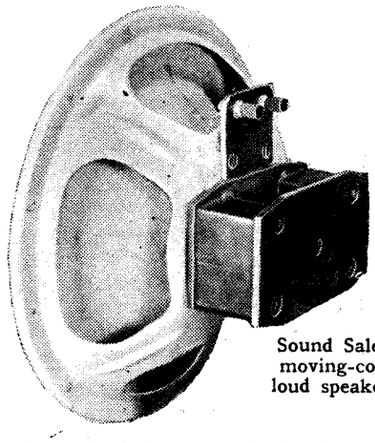
Miniature batteries suitable for the latest lightweight portable receivers and similar appliances have recently been introduced. There is also a complete series of single cells and batteries among which can be found an appropriate source of power for almost any purpose.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.

SOUND SALES (76)

Amid a wide variety of mains transformers and smoothing chokes, quite a large number of amplifiers is to be found on this stand. There is a 12-watt PA amplifier which is provided with tone and volume controls and arranged for microphone and gramophone use. A 4-watt amplifier, the S.S.P.A.12, is listed at £10; push-pull output triodes are used, and a flat frequency response characteristic up to 10,000 c/s is claimed. The S.S.4-12 watt Quality Amplifier, which is similar to *The Wireless World* Push-Pull Quality Amplifier, is also on view.

A new output transformer, the 036, having a frequency characteristic flat within ± 0.5 db. from 20 c/s to 20,000 c/s is to be found, and there is also a number of loud



Sound Sales moving-coil loud speaker.

speakers, including an Auditorium model with dual suspension. It is priced at £12. Small speakers are also shown and include the Sound Junior with a serrated surround at £2.

Battery chargers and microphones are also to be found on this stand, as well as a radio-gramophone. The receiver portion of this is a superheterodyne and an Auditorium speaker is fitted.

Sound Sales, Ltd., Marlborough Road, Upper Holloway, London, N.19.

T.C.C. (68)

In view of present interest in the suppression of electrical interference, to say nothing of the probability of anti-interference legislation, it is natural that the Telegraph Condenser Company should pay special attention to the production of condensers and units for this purpose. These include special types for use in such appliances as vacuum cleaners, refrigerators, etc., and there are also condensers for suppressing motor car interference.

As inductive condensers are worse than useless for by-passing ultra-high-frequency currents, it is equally natural that increasing attention has been paid recently to improving the properties of condensers in this respect. A special feature is also made of surge-proof voltage-regulating wet electrolytic condensers, and in this category there is a new 32-mfd. pattern.

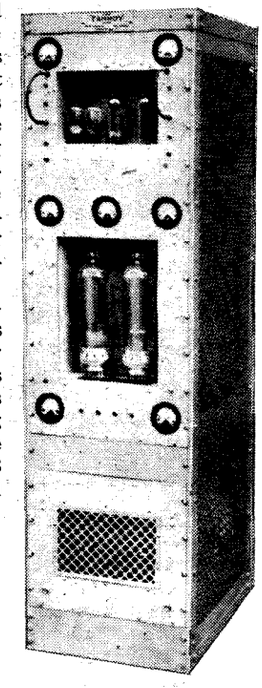
Although one does not look for spectacular developments in condenser design, it has been found possible to improve the damp-resisting properties of the tubular paper types.

Telegraph Condenser Co., Ltd., Wales Farm Road, N. Acton, London, W.3.

TANNOY (45)

Sound amplification in all its aspects is comprehensively covered by the Tannoy exhibit. The amplifiers produced by this firm range from small units giving an output no greater than is needed for the more exacting domestic requirements up to the largest instruments suitable for outdoor public-address installations.

Radio - gramophones of types suitable for schools, hospitals and institutions are also shown; the smallest is the RG5, giving 6-8 watts output and



High-power Tannoy amplifying equipment.

embodying a superheterodyne chassis. A rather more ambitious model gives 10-15 watts.

Various accessories for public-address work are also shown; among these are loud speakers (horn and cabinet types) and microphones, including the recently introduced T type. There is also a portable amplifier.

Tannoy Products, Canterbury Grove, W. Norwood, London, S.E.27.

TUCKER EYELET CO. (105)

The exhibit of this firm is primarily of interest to manufacturers; it embraces a display of small metal press work as used in the radio industry and includes many different types of eyelet which are being used to an increasing extent in radio assemblies, There are also a number of connecting tags of different patterns, those with a tinned finish being, of course, particularly suitable for quick and easy soldering.

George Tucker Eyelet Co., Ltd., Cuckoo Road, Birmingham, 7.

362 VALVES (207)

A wide range of valves is shown on this stand, including pentodes of the transmitting type. Of these the RFP60 is listed at £3; it requires 1,000 volts anode potential with 500 volts for the screen grid. The anode dissipation is 100 watts, and it requires a speech input of 3 watts for 100 per cent. modulation.

Large output valves are also shown as well as many receiving types and there is a range of AC/DC and car radio valves with heaters requiring only 6.5 volts.

The 362 Radio Valve Co., Ltd., 324-326, Liverpool Road, Highbury, London, N.7.

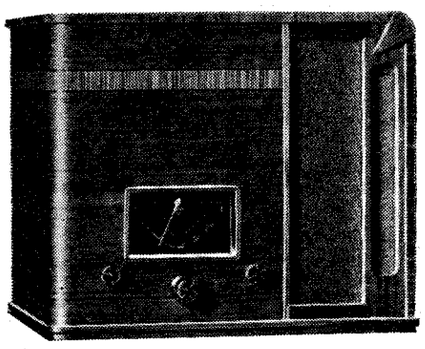
ULTRA (52)

All the receivers in the Ultra range are superheterodynes, the cheapest being the Model 101 at £9 19s. 6d. It is designed for the normal broadcast wavelengths only, and has a triode-pentode frequency changer, pentode IF amplifier, and double-diode-pentode output valve. A battery version

Olympia Show Report—

(Model 103) with QPP output stage is available at 11½ guineas.

Above this price all table models include one or more short-wave ranges, and in the Model 48 at 13 guineas the additional range is from 16.8 to 50 metres. The Model 47 at 17 guineas has two short-wave ranges covering 13 to 35 and 30 to 80 metres.



Ultra Model 48 all-wave superhet.

The two radio-gramophones, Models 96 and 99 at 19 guineas and 25 guineas respectively, have cabinet designs of more than usual interest on account of the edgewise curved tuning scale let into a ledge in the front panel.

Ultra Electric, Ltd., Western Avenue, Acton, London, W.3.

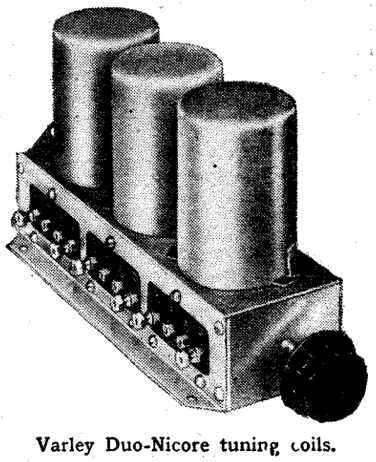
UNIRAD (20)

This firm has for long made a speciality of short-wave apparatus, and they are showing a short-wave converter and a range of all-wave superheterodyne receivers for both mains and battery operation. Overseas models, in which the long waveband is omitted, are also shown, as well as sets built especially for use in the Tropics.

The mains model has one HF stage at signal frequency, a triode-hexode frequency-changer, one IF stage, and two LF amplifiers, the final stage being a pentode giving 3½ watts output. Its wave-ranges are 12½ to 28, 27 to 81, 230 to 550 and 950 to 1,925 metres. This model, the AW5/M7, in cabinet, costs £32, the chassis alone being obtainable at £26.

The battery model has two IF stages as well as an HF stage and QPP output, its price in chassis form, with all-wave facilities, being £24.

Union Radio Co., U.R. Works, Aurelia Road, Croydon, Surrey.



Varley Duo-Nicore tuning coils.

VARLEY (77)

Among the new components being exhibited by this firm are Nicore tuning coils. These are available in various types and include a three-gang unit at 21s. for superheterodynes with an intermediate frequency of 110 kc/s, a two-gang unit at 13s. 6d. for an intermediate frequency of 465 kc/s, and both two- and three-gang units for straight sets. The units include waveband switching.

A new IF transformer for a frequency of 465 kc/s is shown. Iron-cored Litz-wound coils are used with mica-dielectric trimming condensers, and it costs 8s. 6d. There is also a new mains transformer at 37s. 6d. with three filament secondaries; the HT winding is 350-0-350 volts 120 mA.

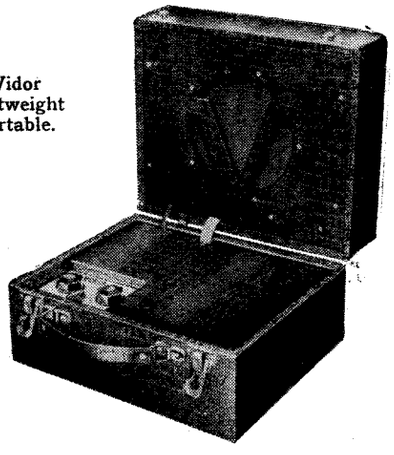
Television components are also on view and include IF transformers suitable for both sound and vision amplifiers, signal-frequency tuning coils and a temperature compensated oscillator coil. A high voltage unit for operating a cathode-ray tube is shown.

Varley (Oliver Pell Control, Ltd.), Bloomfield Road, London, S.E.18.

VIDOR (61)

Prophecy is dangerous in the radio art, but it is fairly safe to say that, failing the application of some radically new principle, the present-day lightweight portable is not likely to be reduced substantially in weight or size. A few pounds or a few inches may be pruned off here and there, but any drastic reductions are likely to be at the expense of performance. A good example of modern tendencies in this direction is the

Vidor lightweight portable.



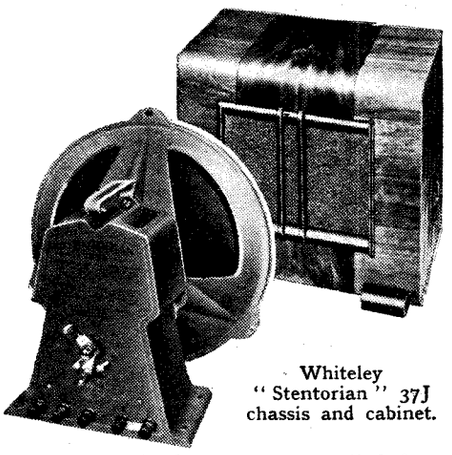
Vidor Miniature Portable, which weighs 14¾lb. and includes an HF-det-LF circuit in which a pentode valve feeds a moving-coil speaker. The set costs £5 18s. 6d.—not an extravagant price to pay for a useful auxiliary to the home receiver.

Among the many domestic receivers shown by Vidor is the Four-band Bandpass Universal All Mains model, which embodies a straight circuit and covers wavelengths between 13.5 and 2,000 metres. A broadcast-band AC superheterodyne with a fairly conventional circuit is sold at the low price of 9 guineas. There is also a superheterodyne converter for use with existing sets which embodies a heptode frequency changer and costs 47s. 6d.

Vidor, Ltd., West Street, Erith, Kent.

W.B. (66)

Superficially the "Stentorian" range of loud speakers is much the same as last year, but there are many improvements which are not apparent to the eye. These include magnets giving a 15 per cent. increase in flux density, exponential cones of new material and completely redesigned "Microlode" universal transformers. Very attractive new cabinets have been designed for the extension speakers, and a new feature has been introduced in the "Long Arm" through



Whiteley "Stentorian" 37J chassis and cabinet.

which the set itself may be controlled from the room in which the extension speaker is installed. This device costs 15s. 6d., and is intended for use with the "Senior," "Junior," and "Cadet" models which incorporate a special push-button and volume control combination.

Whiteley Electrical Radio Co., Ltd., Victoria Street, Mansfield, Notts.

WATERHOUSE (201)

Some fine examples of modern radio furniture are shown on this stand. They take the form of radio-gramophone, console and loud-speaker cabinets in various styles, but, in addition, there is a range of moving-coil reproducers and also small and large PA amplifiers.

Frederick Waterhouse, Ltd., Stanley Works, Edward Street, Dudley Hill, Bradford, Yorks.

WAYFARER (212)

Wayfarer Midget Portables are being shown on this stand, and include the Junior Model at 5 guineas. This has four valves arranged as a screen-grid HF, screen-grid detector, triode LF, and pentode output. The total weight is 9 lb. The Senior Model is similar, but has a detachable frame aerial, and is so arranged that headphones can be used when desired.

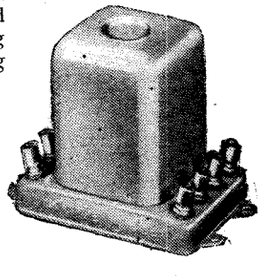
Two larger sets, including moving-coil loud speakers, are also on view.

London Electric Appliances, Ltd., 62, Glengall Road, Old Kent Road, London, S.E.15.

WEARITE (95)

The apparatus on this stand consists of a range of components, prominent among which are coils of various types, and a series of testing units for servicing receivers.

Wearite Unigen general-purpose coil.



Both air- and iron-cored coils are shown assembled in neat metal cases, with wave-change switch included. There is a range of IF transformers for 110 kc/s and for

465 kc/s amplifiers. Some have iron and others air cores. A 465 kc/s air-cored model costs 8s. 6d. and its iron-cored counterpart 9s. 6d.

Short-wave coils, HF chokes, switches and mains transformers, the latter neatly finished and totally screened, are also shown. The type T21C, giving 500+500 volts at 120 mA and having three separate LT windings, costs 32s. 6d.

The testing units comprise a modulated oscillator, a meter unit, which is a versatile multi-range instrument for AC and DC measurements, and a valve-testing panel. They can be used separately or collectively to form a complete servicing test set and cost £6 15s. for the oscillator, £6 17s. 6d. for the meter and £4 17s. 6d. for the valve-testing unit.

Wright & Weaire, Ltd., 740, High Road, Tottenham, London, N.17.

WESTINGHOUSE (36)

In addition to their well-known range of metal rectifiers for HT supply equipment and LT battery chargers, this firm will be showing rectifiers designed for use in television equipment and capable of supplying

Westinghouse high-voltage rectifier for television units.

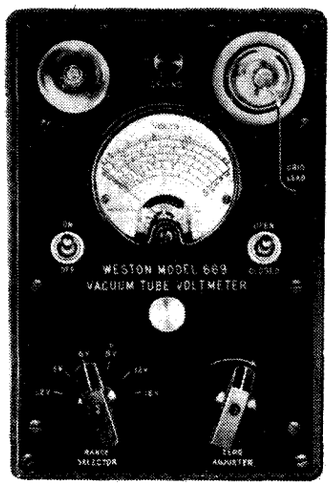
the high voltages necessary for operating the cathode-ray tube. A typical power unit including them is shown.

Instrument type rectifiers will also be on view, as also will be Westectors.

Westinghouse Brake & Signal Co., Ltd., 82, York Road, King's Cross, London, N.1.

WESTON (215)

To the series of servicing test apparatus the Weston Electrical Instrument Co. have this year added a valve voltmeter which is AC mains operated and allows for HF



Weston valve voltmeter, Model 669.

voltage measurements of from 0.1 to 16 volts in six ranges. It can be used also for the accurate measurement of AVC volts. It is a two-valve model and costs £24.

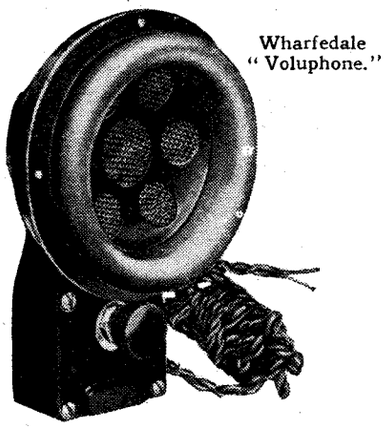
There is also a small output meter for use with portable oscillators and a companion instrument providing facilities for measuring over wider voltage ranges.

A very useful volt-ohmmeter, described as the Model 564, Type 3B, which has a resistance of 1,000 ohms per volt and measures up to 600 volts DC and resistances up to one megohm, is now available at £10 10s. Together with the very versatile Selective Analyser and Super Oscillator, these instruments form an exceptionally comprehensive series of units for the service engineer.

Weston Electrical Instrument Co., Ltd., Kingston By-pass, Surbiton, Surrey.

WHARFEDALE (204)

The 1937 "Golden" chassis with its improved frequency response forms the basis of the Wharfedale exhibit. Complete with universal transformer this unit costs 55s., or without transformer 42s. 6d. The console cabinet which has been produced to house this unit is an interesting innovation, and there are many representative types of extension speaker making use of the "Standard" and "Bronze" units. Special attention is drawn to the 1937 "Coronet" extension speaker with volume control at 52s. 6d.



Wharfedale "Voluphone."

Finally, there is the "Voluphone" which is a miniature moving coil unit with nickel-aluminium magnet and "Truqual" volume control designed as an extension unit for individual listening. The speech coil impedance is 2 ohms, but a separate transformer can be supplied at 7s. 6d. where necessary. The price of the unit without transformer is 39s. 6d.

Wharfedale Wireless Works, 62, Leeds Road, Bradford, Yorks.

G.E.C. Television Receivers

THE television receivers produced by the General Electric Co. and shown at Olympia are in two forms. One consists of a vision receiver in conjunction with an ultra-short-wave receiver and is thus suitable for reception of television with its accompanying sound programme only. The other contains the same vision equipment, but this works in conjunction with an all-wave receiver, so that not only can the sound accompaniment be received but also broadcasting on other wavelengths.

In the former set a signal-frequency HF stage is used which operates simultaneously on the sound and vision channels and is followed by a single triode-hexode frequency changer which produces two different intermediate frequencies from the two signal input frequencies. Two separate IF amplifiers follow the frequency-changer, and the sound amplifier contains two stages using HF pentode type valves followed by a duo-diode-triode detector and LF amplifier and a pentode output valve.

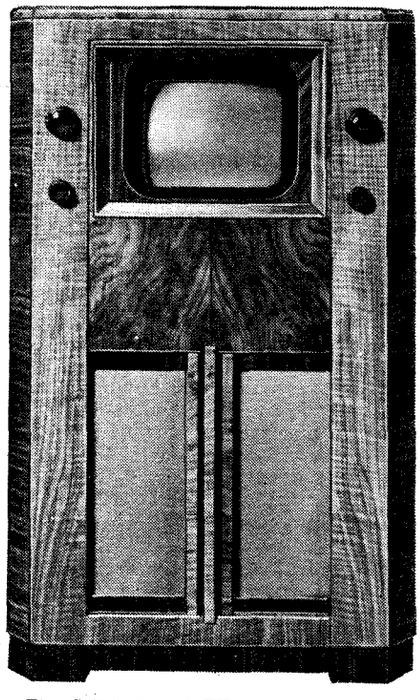
The vision IF amplifier has five stages with HF pentode valves, and is followed by a rectifier and an output pentode, which feeds the vision signal to the cathode-ray tube, and the synchronising pulses to the time-bases through a diode.

A double time-base unit is employed involving two gas-filled relays for the generation of the saw-tooth voltages for the line and picture deflections. The output of each oscillator is amplified by a push-pull stage employing two triodes to obtain a balanced output for the deflection voltages.

The power unit supplies power for the operation of the whole equipment, one rectifier and transformer supplying the whole of the sound and vision receivers, while two other rectifiers working in conjunction with a separate transformer supply the time-base and the cathode-ray tube. The cathode-ray tube itself has a diameter of 12in. and is enclosed in a metal container and viewed directly. Electrostatic deflection is used.

A particular feature is made of the manner in which the apparatus is protected. Fuses are used in all appropriate circuits, and not only is the mains plug permanently attached to the back of the cabinet, but safety switches are fitted so that the removal of the back opens the mains circuit and so switches off the apparatus.

The controls are in no way excessive in number nor difficult to adjust. The tuning control is operated in the ordinary way for maximum volume of sound, and the vision tuning is then automatically correct. The sound volume control is also entirely normal. A switch is fitted for changing over the time-base circuits for reception of the two different methods of transmission—Baird and Marconi-E.M.I. Then there are three vision controls: first a vision gain control which modifies the picture contrast; secondly,



The G.E.C. Model BT. 3701 sound and vision receiver.

a horizontal lock control; and thirdly, a vertical lock control.

Certain other controls are fitted of a subsidiary nature which require only occasional adjustment. By their use the brightness, focus and size of the picture can be controlled, while the synchronising is capable of adjustment.

The sound and vision receiver has the list number of BT.3701 and contains 23 valves. The all-wave model is Type BT.3702.

Readers' Problems

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers.
Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

Working Voltage Doubled?

WE are asked to say whether it would be safe to use in a 500-volt circuit a pair of 4-mfd condensers rated for working at 250 volts if the condensers were connected in series. It is realised, of course, that the capacity would be reduced by half.

For reasons that have already been pointed out in these columns, the subject of

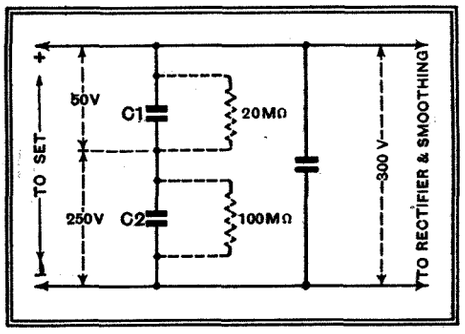


Fig. 1.—Unfair distribution of strain; voltage is not equally distributed between a pair of series-connected condensers unless their leakage resistances are similar.

series-connected condensers and their safe working voltage is not so straightforward as it would appear. Leakage is the trouble; even the best of condensers have not an infinite resistance, and if leakage values of the series-connected pair happen to differ widely, the voltage distribution between them will also be unequal, varying in proportion to the ohmic resistance. What might happen in a typical case is illustrated in Fig. 1, where two condensers connected in series are joined across a 300-volt line. With the leakage values as given in the diagram, the voltage will not be equally distributed between the two, but one condenser will be called upon to withstand 50 volts and the other 250 volts.

There is, fortunately, a fairly simple way out of this difficulty. For all practical wireless purposes, the connection of a resistance (of very much lower value than any normal leakage likely to be met with) across each condenser will equalise the voltage distribution and so prevent either condenser from being called upon to bear an undue proportion of the load. A value of 1 megohm is generally safe for this purpose.

The Perfect "Mixer"

VARIOUS ingenious methods have been devised for mixing the outputs of different microphones or pick-ups before application to the amplifier, but most of these are liable to more or less serious criticism, at any rate on academic grounds, since the volume controls of the individual instruments are not entirely independent of each other.

A reader who has appreciated this point has come to the conclusion that, as he does not object to a little additional complication, the use of separate input valves for each "channel" would be safest, and asks our advice on this subject.

Our queriest is undoubtedly right; a separate input volume control can be provided for each valve without any risk, while the anodes of all the valves may be joined together and linked with the succeeding amplifying valves by a common coupling.

Background Noises

IN a well-designed modern receiver it is probably correct to say that, if all external causes are ruled out, the most common source of unduly noisy background is a defect or misadjustment in the signal frequency circuits. Anything that tends to reduce the sensitivity of this part of the set is bound to accentuate such troubles, and a correspondent who writes on this subject would be well advised to make a careful test of the input circuits and HF stage of his superheterodyne.

What Is Instability?

AN infallible indication of HF (or IF) instability is given when uncontrollable self-oscillation is produced as the various circuits of the receiver are brought approximately into tune with each other. A reader's letter dealing with an unsatisfactory two-stage IF amplifier shows that the writer fails to appreciate this point; he says, "the amplifier cannot be unstable, because a setting of the trimmers can be found at which there is no sign of oscillation, but sensitivity is then poor."

The trimmer settings corresponding to stability undoubtedly correspond also to out-of-tune conditions, and there can be no doubt that the amplifier is inherently unstable. If our correspondent will send us a circuit diagram and full details, we may be able to offer some suggestions.

Effect of AVC

IT should be emphasised that in every system of AVC the anode current of the controlled valve should tend to fall as the set is tuned to strong signals.

One or two readers do not appear to appreciate the fact that the opposite effect—a rise in current—is a clear indication that the automatic control system cannot be working properly. A rise in current would suggest that the controlled valve is acting as an anode bend rectifier, and that, through some misconnection or breakdown, it is working with excessive negative bias.

The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial designs which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

The PA Amplifier

IN spite of the present-day tendency to use bigger output valves, the consumption of the average set or amplifier is still almost negligible when compared with other domestic appliances. Even the PA Amplifier, with its exceptionally large output, is quite modest in its demands. Readers who have written on this subject will be reassured to know that the instrument consumes about 180 watts when supplying any receiver unit up to the limit of its capacity.

The Starting Process

EVERYONE knows that the ordinary mains receiver takes half a minute or so to warm up to its work; it is not so generally appreciated that conditions of stability are not reached in the average superheterodyne for half an hour or so, and that during this time a certain amount of "drift" in tuning may occur.

This is particularly noticeable on short waves, and, to get the best out of a set, an occasional readjustment during the period may be necessary. A queriest who finds that he has to make such adjustments has no reason to think any defect exists in his receiver.

The Balancing Condenser

A READER asks us the correct way to connect a condenser for balancing out the "vertical pick-up" of a frame aerial with which he wishes to carry out some directional reception experiments.

The usual connections are those given in Fig. 2, in which the condenser C (which is normally of the single-plate variety) is adjusted by trial and error to a value equal to

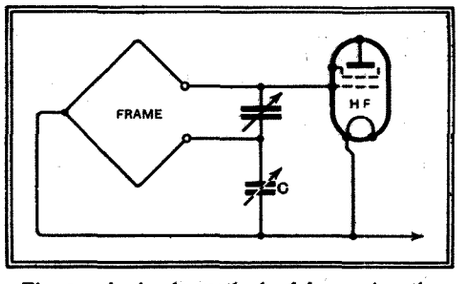


Fig. 2.—A simple method of improving the directional properties of a centre-tapped frame aerial.

the grid-filament capacity of the input valve of the receiver. The input circuit, balanced in this manner, becomes symmetrical, and the vertical pick-up (i.e., the tendency of the frame to act as an open aerial) is balanced out.

Maintaining the Anode Load

AS various contributors to our pages have pointed out, the difficulty of applying a stage of drastic tone correction to a receiver is that the load in the anode circuit of the controlling valve is apt to be so low that the tendency towards harmonic distortion is seriously increased.

Several readers have sought to overcome this trouble by employing a shunt-fed transformer coupling after the tone-correcting circuit, with the object of maintaining a high value of load. They forget, however, that the load still remains at some value less than that of the tone-correction network, and so nothing is gained.

News of the Week in Brief Review

CURRENT TOPICS

The German Wireless Exhibition

THE leading feature of the show which is now in full swing in Berlin is said to be quality of reproduction. Manufacturers have devoted special attention to this feature, even on the smallest sets, and a very marked improvement is shown over the receivers exhibited last year. German designers are tending more and more to employ the horizontal type of consolette instead of the vertical type, which is still the leading design over here. A special section of the exhibition is given over to the German Post Office, in which may be seen models of the various types of transmitting aerials used to combat fading. In this section demonstrations are given on the principal types of receiver in use in Germany. As at Olympia, the entertainment side of the show looms large, and special concerts are given from the exhibition grounds, these being usually of a classic nature.

The Most Popular Exhibit

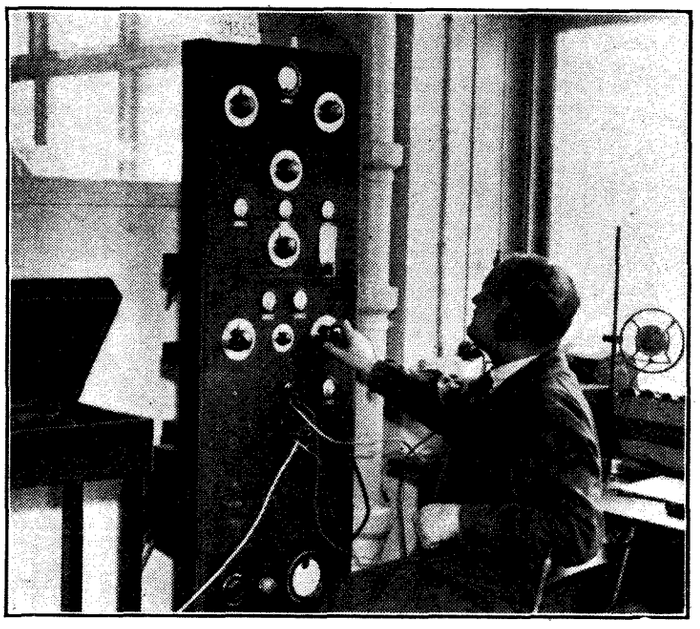
TELEVISION is undoubtedly the most popular feature of the German show. The Post Office authorities are well to the fore educating the public as to the great progress which has been made in the science during the past year, and a leading exhibit in this section is the P.O. travelling van with its improved "intermediate film" apparatus, while side by side is the direct scanning gear. A model is shown of the "Funkturm" with its twin ring aerials for sight and sound broadcasting. The particular exhibit which is attracting most attention, however, is the special televisophone installed between Berlin and Leipzig. This has been extended to the Exhibition, so that visitors may have "visual" telephone conversations.

French Wireless Exhibition

NEXT Thursday will see the opening of the 13th wireless salon, which will be held in the Grand Palais on the Avenue des Champs-Elysées. As at other exhibitions, great prominence is to be given to the television section, and it is thought that this fact alone will ensure a record attendance, more especially as efforts are to be made to give demonstrations of the reception of television under home conditions.

Commentators' Association

DURING the recent Olympic Games in Berlin there was gathered together a large number of broadcast commentators from the various countries of the world. These commentators held a meeting at which it was decided to form a radio reporters' world association. The drawing-up of the rules governing the organisation has been left to a special committee. Ordinary announcers are, it is said, to be allowed to join the association if they so desire, but possibly a special section will be created for them.



SWEDEN'S OFFICIAL SHORT-WAVE STATION. In contrast to most other European countries, Sweden does not possess any official short-wave broadcasting stations. The role of national SW transmitter is at present undertaken by an amateur, Dr. Siljeholm, who is seen here at the controls of his transmitter which may be frequently heard on the 40-metre band.

Red Hot News

THE office of the Chief Announcer of the National Broadcasting Company in New York has been converted to a studio so that important news bulletins may be speeded up. In cases where news messages are of extreme urgency or of great national importance, the announcer on duty in this studio can immediately switch the entire network of stations over to his microphone for the necessary announcements.

Radio Facilities for Air Travellers

INCREASING use is being made by air travellers of the arrangements for the interchange of wireless messages with correspondents down below. As in the case of ships at sea, the aeroplane actually works with the nearest land station, the telegrams being sent across country by normal routes. This facility is available for passengers flying over Empire airways, but at present no messages can be sent or received *via* European stations, with the exception of those in Italy. In India messages can only be sent from the aeroplane to the ground and then only for destinations in India or Burma. It is hoped before long that these limitations will be swept away. The day may not be far distant when aeroplanes in flight will form part of the world-wide telephonic service.

Revelations !

IT is somewhat surprising to learn that in some parts of the country the cost of installing and maintaining school receivers is defrayed by the teachers and not by the educational authorities. An investigation just completed by the Staffordshire County Association of the National Union of Teachers shows that only eighty-one out of 490 schools possess wireless sets, and that in only five out of these eighty-one cases has the local educational authority paid for the set. In many cases valuable broadcasting lessons have had to be discontinued because no funds have been available for replacement of valves and other maintenance charges. It is stated that conditions in Staffordshire are fairly representative of those existing in other parts of the country.

Five-metre Competition

ON Sunday, September 13th, the Golders Green and Hendon Radio Scientific Society are holding a five-metre field day, which on this occasion is arranged to take the form of an open competition. Those wishing to take part should notify the assistant hon. secretary, Mr. A. G. Griffith, Hornbeams, Priory Drive, Stanmore, Middlesex, not later than September 3rd next.

A State Subsidy ?

CONSIDERABLE embarrassment is said to have been caused to the French radio trade by the new conditions of employment which have been introduced. These conditions, which, in brief, consist of shorter hours and higher wages, will, it is said, need a great expansion of existing trade if they are to be maintained on an economic basis. In order to ease the situation, a prominent French journal has put forward the suggestion that the Government should immediately give an order for 50,000 new receivers to be used in schools, barracks and hospitals for educational purposes. This suggestion has aroused considerable opposition, however, since it is realised that it is merely a State subsidy in very thin disguise.

Photo-telegraphy to the Rescue

AN important address on the communications of the Empire was recently given to the summer school of the Royal Empire Society by the Chairman of Cables & Wireless, Ltd. During one week in 1935 as many as 1,250,000 words were handled on the wireless circuit of the company. A remarkable instance of the value of the photo-telegraphy service occurred last year when a special chart was urgently required to enable a break to be located in a cable in the Indian Ocean. A facsimile of the chart was wirelessed from London to Melbourne, which enabled the cable ship to set out immediately instead of waiting until the original document arrived.

RANDOM RADIATIONS

By "DIALLIST"

HOW time does fly! It seems difficult to believe that a whole year has gone since we were last at Radiolympia. But gone it has, and here we are once more with the Wireless Exhibition in full swing. The later opening date is an improvement, for August is traditionally the holiday month, and an exhibition that goes on for five whole days into September is sure to attract many who were not able to attend in past years owing to previous engagements at the seaside or in the country.

This note is of course written some days before the opening, but one has already a fairly good idea of the things that are going to be worth seeing—though some makers are keeping surprises up their sleeves and will not divulge them until the last moment. One thing that I am very glad to note is that not a few makers are turning their attention more towards high quality in reproduction. Their sets will be well worth examination, though unfortunately the "piped" speech and music relayed at the Exhibition give one no chance of hearing what the audio-frequency sides of the sets can do.

Tuning Indicators

A YEAR or two ago, when sets cost rather more than they do now, it seemed as if the visual tuning indicator was going to become part and parcel of every superhet. As things have worked out it is seen nowadays only in a certain number of them—and not all of the higher-priced ones have it. The reason, I suppose, is that when you have to design moderately-priced sets for a highly competitive market you must spend the money available on such gadgets as have most "selling points" for the man in the street. The visual tuning indicator may strike him as something far less attractive than, say, inlay work in the cabinet or some novelty in the way of dials. He doesn't realise how exceedingly difficult it is to tune a superhet with automatic volume control by ear. If you doubt me hook a milliammeter into the plate circuit of your intermediate frequency valve (or the second of them if there are two) and place it so that it can't be seen by the person who is handling the tuning-knob. Then get two or three of your friends to have a shot at tuning in the local station by ear, and you will, I think, be surprised to find how often they are satisfied with a setting that is some way from the right one. As everyone knows, the quality of superhet reproduction is very much affected by incorrect tuning; hence it is rather surprising to find that sets which claim to be capable of high quality are unprovided with visual indicators.

Exit HTB Tappings

A week or two ago I mentioned that at least one manufacturer had cast out the grid battery from his sets and was using just two high-tension connections, positive and negative. The negative grid bias for such valves as require it is, of course, obtained by the use of suitable resistances. I am glad to see that several other makers have adopted the same system, and I hope that ere long we shall find it in all battery sets. It is the only sound method, and I have always detested sets which require you to make perhaps a dozen connections to grid and high-tension batteries. One of the worst points about them from the layman's point of view is that though the high-tension battery lets him know when it is qualifying for the dustbin, the grid battery doesn't and too often he lets it continue for weeks in a nearly run-down condition, thus unconsciously ill-treating both his valves and the HTB.

Some of the very cheap grid batteries on the market nowadays have a remarkably short "shelf" life—and then, of course, you can never tell how long they have been in stock when you pay your money and take your choice. Yes, I know there's a voltmeter test. But who tests the voltmeters?

Radio Charing Cross

IF you happen to go to Charing Cross Underground Station either on your way to Radiolympia or when about your ordinary occasions, don't fail to visit the little exhibition that is being staged in the booking hall till September 3rd. Arranged by Cable and Wireless, Ltd., it gives one a wonderful idea of the extent and the speed of methods of communications to-day. You may see there all the latest devices in use for both wired and wireless signalling as well as a replica of one of Marconi's earliest instruments. There's also a section of the first submarine cable, which was laid between Dover and Calais in 1849 and worked for just one day. Not the least interesting of the exhibits is the original radio patent granted to Marconi in 1896.

I've called your attention to these little exhibitions at Charing Cross before now. Whenever there's one on it's worth going to, for whoever organises them seems to have the happy knack of showing interesting things in an interesting way.

An Exhibition Suggestion

A CORRESPONDENT sends me a suggestion for the Exhibition which would seem to have certain possibilities. He lives a long way from London, and though he is the keenest of keen wireless men it is very seldom that he can manage to visit Olympia. His idea is that the Exhibition authorities might have a postal department to which those unable to be present in person might apply. This department would send to applicants envelopes containing descriptive leaflets (published by the manufacturers) of any particular thing in which they were interested. Thus, you might write saying that you wanted to know about the latest valves or variable condensers or power transformers or other components. Or again, your enquiry might relate to AC mains superheterodynes priced from £12 to £15. Possibly, again, your interest might be in battery portables or car radio.

Whatever your query you would receive from the publicity department particulars of anything suitable that was shown by exhibitors. If it were adopted the scheme might have excellent results. I don't think it would cost anything much to run, for my correspondent says that he would willingly pay sixpence or a shilling for a packet containing the particulars that he wants, and I have no doubt that there are thousands of others like him. Possibly, too, there are many actual visitors to the Exhibition who would be ready to buy classified packets to save the trouble of collecting a mass of leaflets from the stands.

Letters to the Editor

The Editor does not hold himself responsible for the opinions of his correspondents

Television Interference

WHILE listening to London Regional about 12.20 p.m. on Monday, August 17th, I heard the B.B.C.'s usual tuning note superimposed on the normal programme. Detuning the receiver resulted in the Regional programme disappearing, but the tuning note persisted. Later the tuning note was replaced by a dance band rehearsal with considerable horseplay. Long breaks in the music were filled up with a noise similar to that resulting from "motor boating." The signal strength was the same at every setting of the dial and considerably stronger than the Regional, i.e., with the Regional at resonance the band playing was sufficiently strong to swamp out the Regional programme.

My position, about half a mile from the Alexandra Palace, suggests that the signal was the television sound transmitter testing. Connecting up a one-valve battery 5-8-metre set (no super-regeneration), tuned in the same programme at good earphone strength—the aerial being a 7in. frame. At no time was any announcement heard.

The set on which the interference occurs is a HF-det.-LF, with screened tuning coils, the aerial being indoors and about 35ft. long. In the next room I have a det.-LF triode set with unscreened coil, the aerial being outdoors and 90ft. long. On the latter set the interfering signal is nearly inaudible.

Do you think my supposition as to the source of the interference is correct, and, if so, how? DANIEL BROWNING.

London, N.10.

Television from Germany

ON August 14th, between 8.30 and 9 p.m. B.S.T., I received quite unexpectedly a German broadcast on a wavelength of about 7.2 metres. I was listening on a simple super-regenerative receiver for the Alexandra Palace, but got this instead.

The transmission on 7.2 metres was a commentary in German on some open-air sports event. There was a picture channel operating at the same time on about 6.8 metres, but was rather weaker than the sound channel.

The sound channel had the characteristics of a long-distance signal, in that rapid periodic fading of about two seconds' duration was superimposed on a slow fade. At times the signal was quite loud in a pair of headphones without any super-regeneration.

Signals disappeared entirely as darkness came at about 9 p.m.

I can only conclude that I was receiving the Berlin television transmitter as the result of some abnormal condition.

E. HOWARD ROBINSON.

Cheam, Surrey.

Whither Exhibitions—What the Public Wants

MR. WARBURTON has completely missed the point of my article, and it is easy to see why. He calls on set makers to devote more attention to battery sets and self-contained sets. Technically educated people, whilst realising that a battery set is sometimes the only type which can be used, know quite well that the output power is inadequate for good reproduction; they also know that, with a good outside aerial, the signal to noise ratio is much more satisfactory.

Mr. Warburton details a "good" set bristling with all sorts of wonderful features; the only features he forgets to describe are frequency response and output power. Also, I have no evidence that the adoption of cheap moving-coil speakers *has* brought about an improvement in "tone." Set makers pay less for moving-coil units than they used to pay for moving iron speakers, and, because the best speakers are moving-coil, it does not follow that moving-coil speakers, irrespective of price, are the best speakers. Evidence to the contrary is all around us.

Mr. Warburton states that a really good set must cost £50 or more. My company is prepared to supply a really good set at less than £30, but he may not think it is a good one because it has not "great range" and needs an outdoor aerial.

I did not say that the public should be educated into demanding better reproduction. I said that the public, because of economic conditions beyond their control, had been "de-educated" into accepting worse reproduction.

It is obvious that Mr. Warburton is not interested in the musical qualities of a radio receiver, and there are thousands like him. I suppose they will all go to the show and enjoy it. On the other hand, there are thousands of people who require their radio set to give a close approximation to the original, and they have as much right to their opinions as Mr. Warburton and those who belong to his type. They can get no satisfaction from the present sort of radio show, and that is why I wrote as I did.

H. A. HARTLEY.

Isleworth.

ONE may perhaps grant that Mr. Hartley is rather "unproletarian" in his desire to see the Great British Public educated into paying more for its receivers, but I would suggest that both he and the contributor of "What the Public Wants" have lost sight of the more significant issue.

Speaking as a mere customer, I am prepared to admit that a price-cutting war is intrinsically evil. The trouble is surely that the large manufacturers, in their search for easily digested sales-points, have taught the public to look for the wrong features of design. Instead of emphasising the need for adequate frequency response and freedom from harmonic distortion they have turned to the more exciting blurb about "QAVC, 123 stations, Magno-prismato-telescopic dial, Neo-cubist cabinet," etc.—in fact, all the usual pseudo-scientific propaganda that the average reader of the popular Press appears to take such a delight in absorbing.

As a result of all this, how many low-priced sets can show any of the following features, none of which are as cost-raising as the present plethora of "stunts"?:—

(1) A loud speaker with diaphragm suspended at the outside edge by some material sufficiently flexible to allow full low note response; *not* by corrugations in the cone material itself.

(2) A triode output valve.

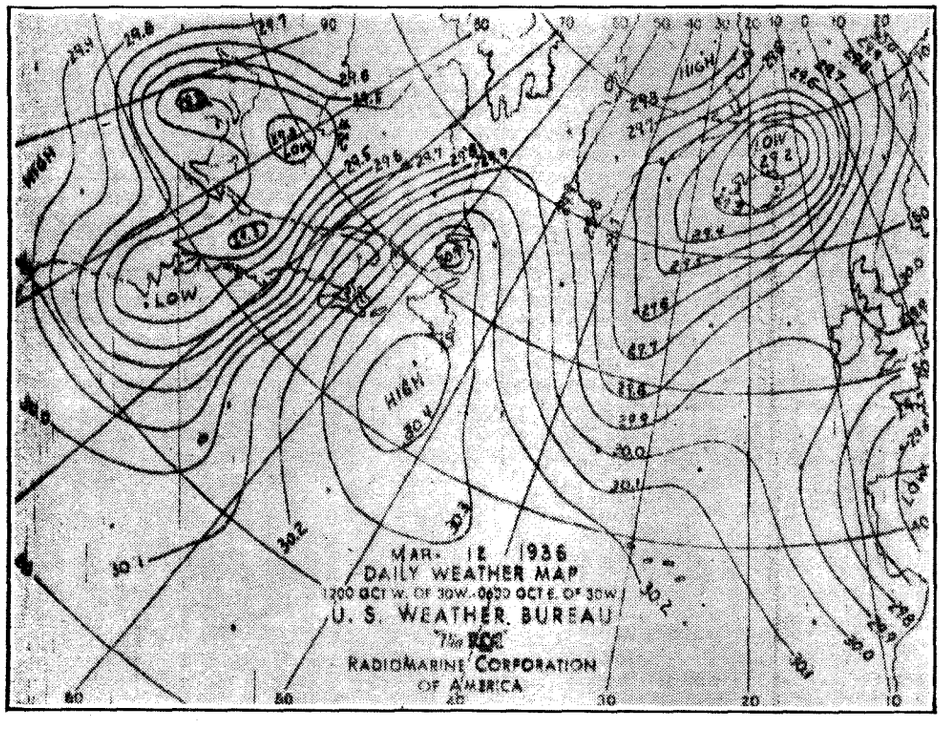
(3) A cabinet giving proper baffle area and reasonable freedom from resonances, instead of being encumbered with the usual pointless (and often technically undesirable) external flourishes.

(4) An output transformer which is just a little bit larger than a match-box.

I venture to suggest that many people would find it an illuminating experience to hear a receiver, costing well below the £10 mark, but built with attention to such elementary quality-getting points as the above. They would realise how vastly one could improve upon present standards of reproduction without even reaching Mr. Hartley's figure of £15, let alone such sums as £50.

M. CAMPBELL, B.Sc.

S. Croydon.



A weather map as received on the apparatus shown in the accompanying photograph.

B.B.C. and the Olympic Games

CONGRATULATIONS on your editorial.

W. ARTHUR SADGROVE.

S. Croydon.

I HAVE been a reader of *The Wireless World* for ten years, having been introduced to your excellent journal by the "Everyman Four" in 1926.

Until this week's issue I held the impression that yours was first and foremost a technical paper, but the editorial comment and the reproduction of two letters from *The Daily Telegraph* on the recent Olympic broadcast have made me begin to doubt this.

As to whether the opinions expressed by the writers of these letters are right or wrong I express no opinion, but I venture to express *this* opinion, that their inclusion was hardly wise for a technical journal.

Anything touching on politics is best left alone, especially as, through being a reader of *The Daily Telegraph*, I happen to know that letters expressing the opposite point of view concerning this particular broadcast were also published in that journal.

Enfield. EDWARD H. COMYNS.

NEW MARITIME AID. The Radiomarine Corporation of America is installing facsimile recorders on a number of vessels, with very gratifying success. The photograph shows equipment of the "Ile de France," taken on a recent voyage, and the weather map is reproduced on a reduced scale from an actual record received on board. The dimensions of the original weather map as received on the recorder were approximately 10" x 7½".

Recent Inventions

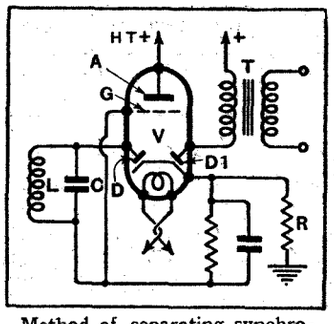
The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

TELEVISION SYSTEMS

THE picture signals in an "interlaced" system of television may be taken to modulate the carrier wave to between 30 and 100 per cent. The synchronising signals are fixed at some level outside this range, say, zero modulation, whilst "background" changes are secured by varying the carrier amplitude about a mean datum line, which itself varies in accordance with the average "brightness" of the transmitted picture.

The object of the invention is to separate the synchronising impulses from the picture signals by utilising differences in the amplitude of the two at the receiving end. If the incoming signals are fed to the circuit L, C of the double-diode valve V, the mean potential of the control grid G will be the same as that of the diode D, since both are connected to the same oscillatory circuit.



Method of separating synchronising and picture signals in television receiver.

But the mean potential of both these electrodes will be negative to the cathode, owing to the electron flow which takes place during the positive half-cycles. The mean current flowing through the main anode A also develops a bias across the resistance R which makes the diode D1 slightly negative to the cathode.

The picture signals are rectified by D and applied to the control grid G, the biasing voltage across R being then applied to the Wehnelt cylinder of the cathode-ray receiver. Synchronising signals, being of greater amplitude, throw the control grid more negative and so decrease the electron flow to the main anode A. The space current to the diode D1 then increases and is used to control a time-base circuit through the transformer T.

P. W. Willans and Baird Television, Ltd. Application date November 2nd, 1934. No. 446432.

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FLUORESCENT SCREENS

THE light emitted from the fluorescent screen of a cathode-ray television receiver is not truly white. In order to offset this, and to produce a more natural effect, the area surrounding the screen is illuminated by light of another colour, which may be complementary to the fluorescence, but is not necessarily so.

For instance, if the picture is slightly yellow it will appear to take on a more natural colour if the screen is surrounded by an area of red or orange. This marginal light may be projected from behind the picture through a coloured screen illuminated by a white lamp. The coloured area, which should have a width approximately equal to the diameter of the viewing-screen, is separated from the latter by a dividing line of black.

General Electric Co., Ltd., and B. P. Dudding. Application date March 26th, 1935. No. 445978.

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ALL-WAVE RECEIVERS

IN order to preserve a uniform gain throughout the whole of the tuning range of an all-wave receiver, but more particularly on the short-wave band, an extra amplifying-stage V2 is automatically brought into circuit between the aerial and the first HF amplifier V, on the short-wave position of the wave-change switch. The arrangement is distinguished from the use of the well-known short-wave "adapter," since the valve V2 involves no change of frequency in the signals which pass through it.

The figure shows a superhet receiver designed for three separate signal-bands, the wave-change switches marked S---S5 being ganged together. The switch S5 controls the local-oscillator circuit of the pentagrid converter V1. The secondary windings of all the coupling transformers are provided with trimming condensers, these being respectively shunted across the main tuning condensers C, C1.

Marconi's Wireless Telegraph Co., Ltd. (assignees of W. La V. Carlson and V. D. Landon). Convention date (U.S.A.) September 30th, 1933. No. 445033.

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WIRED WIRELESS

TELEPHONE lines are adapted to be used for supplying broadcast programmes without interfering with the ordinary use of the line for conversation between one subscriber and another. When the instrument is lifted to make a call, the broadcast programme is automatically cut out by a relay, whilst a second relay similarly open-circuits the broadcast loud-speaker on the receipt of an incoming telephone call. The broadcast programme can thus be left on indefinitely, though it is automatically silenced during the time when a call is either being made or received.

N. V. Philips Co. Convention date (Holland) March 8th, 1935. No. 446044.

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CATHODE-RAY TUBES

IT has been found that successful focusing of the electron stream in a cathode-ray tube depends, to a large extent, upon the separation between the cathode and the aperture in the cathode shield, for a given disposition of the remaining electrodes. The invention describes a method of assembling the cathode and its shield, and of supporting them in such a way as to facilitate the necessary adjustments for focusing. In particular it also ensures that the centre of curvature of the emissive surface of the cathode is located on the axis of the cathode shield.

F. H. Nicoll. Application date October 24th, 1934. No. 446180.

AERIALS

A WIRELESS aerial which is stated to be unaffected by weather conditions is built up of a series of small inverted cones, threaded one above the other on a metal rod. The assembly is carried by an insulated bracket, which is fixed to the sides of a wall or chimney. The down-lead is taken from the lower end of the rod.

K. T. Hardman. Application date November 20th, 1934. No. 446441.

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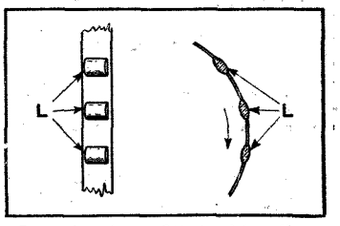
SCANNING DISCS

ANY scanning spot of definite size introduces a certain amount of distortion. One type of distortion occurs in the direction of the scanning line, and the other in a direction at right-angles. The invention is designed to correct

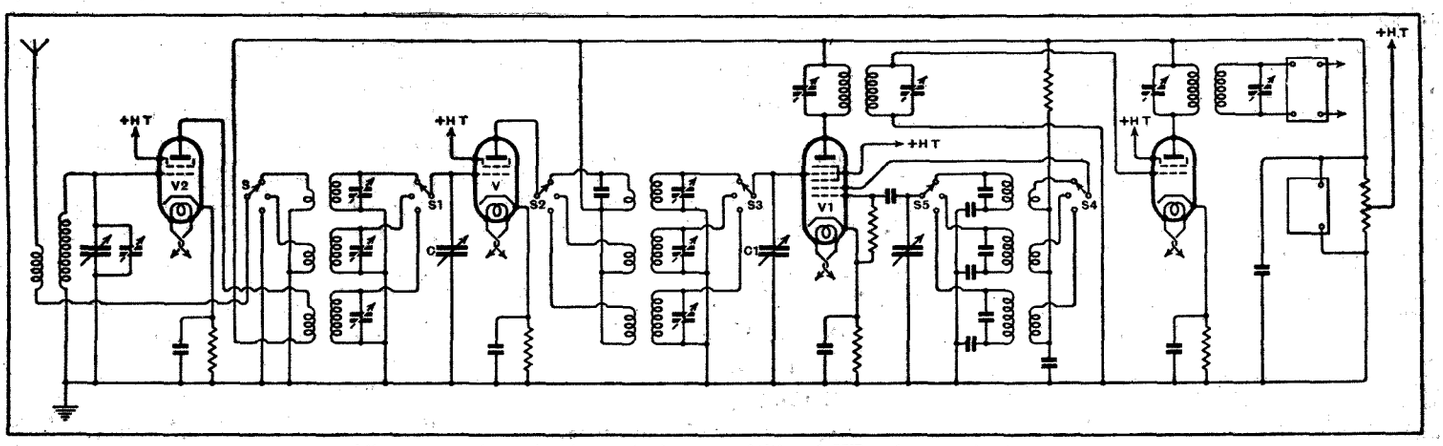


Scanning drum fitted with cylindrical lenses to correct for distortion.

the first type of distortion which, in the case of a rectangular spot, tends to "take off the corners" of the picture signal-wave.

For this purpose the scanning drum is fitted with cylindrical lenses L, of the shape shown in the figure, and set with their axes parallel to the axis of the drum. The aperture and the image are set at the conjugate foci of the lenses, and the latter are so arranged that while they do not affect the breadth of the exploring spot they reduce the ratio of its length to its breadth, thus increasing the definition of the picture. The scanning beam may be focused by a second series of lenses, crossed with respect to the first, and either fixed or moving with them.

Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett, and L. E. Q. Walker. Application date October 19th, 1934. No. 445938.



All-wave receiver circuit employing an additional HF valve on short waves.